U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-286 040

Occidental Chemical Company, Swift Creek Chemical Complex, Hamilton County, Florida. Summary Document

Environmental Protection Agency, Atlanta, GA Region IV

Jul 78

United States
Environmental Protection
Agency

Region 4
345 Courtland Street, NE
Atlanta, GA 30308

EPA 904/9-78-012
JULY 1978

PB 286 040

DRAFT

EPA

Environmental Impact Statement

Occidental Chemical Company
Swift Creek Chemical Complex
Hamilton County, Florida

Summary Document

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U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET

1. Report No. EPA 904/9-78-012

2.

ecipient's Accession No. PB286040

4. Title and Subtitle
Draft EIS Occidential Chemical Company, Swift Creek Chemical Complex, Hamilton County, Florida

5. Report Date July 1978

6.

7. Author(s) EIS Preparation Section, EIS Branch, EPA Region IV

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
EIS Branch, Region IV, EPA
345 Courtland Street, N.E.
Atlanta, GA 30308

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Address
SAME

13. Type of Report & Period Covered Draft EIS

14.

15. Supplementary Notes

16. Abstracts

This Draft EIS concerns the issuance of an NPDES permit to Occidential Chemical Company for the construction of a new chemical plant in Hamilton County, Florida. The construction of the new Swift Creek Chemical Complex is part of a two-phased plan to increase the superphosphoric acid capacity of the north Florida phosphate fertilizer manufacturing complex. The facility will require approximately 50 acres for the plant and 275 acres each for a gypsum stack and cooling pond. Potential sources of pollution are air emissions (suflur dioxide, particulates, and fluorides), process water and nonprocess water. Impacts of emissions on air quality and surface and ground water were examined.

17. Key Words and Document Analysis. 17a. Descriptors

phosphate chemical plant
phosphoric acid
fluoride
gypsum pond

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) UNCLASSIFIED

20. Security Class (This Page UNCLASSIFIED

21. No. of Pages 263

22. Price A12-A01

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EPA 904/9-78-012
NPDES Application Number:
FL0036226

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

for

Proposed Issuance of a New Source National
Pollutant Discharge Elimination System Permit

to

Occidental Chemical Company
Swift Creek Chemical Complex
Hamilton County, Florida

U.S. Environmental Protection Agency
Region IV
345 Courtland Street, NE
Atlanta, Georgia 30308

Approved:

John C. White
Regional Administrator

July 1978
Date

Summary Sheet For Environmental
Impact Statement
Swift Creek Chemical Complex
Occidental Chemical Company

(X) Draft
( ) Final

U. S. Environmental Protection Agency, Region IV
345 Courtland Street N.E.
Atlanta, Georgia 30308

1. Type of Action: Administrative (X) Legislative ( )

2. Description of Action: Occidental Chemical Company is proposing to increase the superphosphoric acid capacity of its north Florida phosphate fertilizer manufacturing complex. Increased capacity will be provided by a two phased expansion: Phase I involves modification of the existing Suwannee River Chemical Complex; Phase II proposes the construction of a new chemical plant, the Swift Creek Chemical Complex. The EPA Region IV Administrator has declared the Phase II expansion to be a new source as defined in Section 306 of the Federal Water Pollution Control Act Amendments of 1972.

In compliance with its responsibility under the National Environmental Policy Act (NEPA) of 1969, EPA Region IV has determined that the issuance of a new source National Pollutant Discharge Elimination System (NPDES) permit to the proposed Swift Creek Chemical Complex would constitute a major Federal action. Therefore, this Environmental Impact Statement was prepared in accordance with the requirements of NEPA and the EPA January 11, 1977, regulations: Preparation of Environmental Impact Statements for New Source NPDES Permits (40 CFR 6.900).

The proposed chemical complex will be located at a site adjacent to the existing Swift Creek Mine, approximately five miles west of the existing Suwannee River Chemical Complex. The facility will require approximately 50 acres for the plant and 275 acres each for a cooling pond and a gypsum storage impoundment, with additional acreage for utilities and transportation rights-of-way.

Process units and related facilities will include a phosphate rock transport system, two contact double absorption sulfuric acid plants, a dihydrate wet process phosphoric acid plant, phosphoric acid evaporation facilities, a phosphoric acid clarification plant, and two superphosphoric acid plants.

The proposed chemical complex will have a capacity of 500,000 metric tons/year of superphosphoric acid. Sulfuric acid will be produced on-site to satisfy process requirements. It is planned to supply wet unground phosphate rock from the existing Swift Creek Mine. By-product steam from the sulfuric acid plants will be used to generate 60 percent of the electric power requirements, with the balance supplied by Florida Power Corporation. A gypsum stack and cooling pond will be provided to store by-product waste gypsum from the phosphoric acid plant and to provide atmospheric cooling for recirculated process water.

In connection with a trade agreement between Occidental and the U.S.S.R., superphosphoric acid will be traded for ammonia, urea and potash. The superphosphoric acid will be shipped from the port of Jacksonville.

3. Summary of Major Environmental Effects

(A) Construction

The proposed Swift Creek Chemical Plant will be constructed adjacent to the existing Swift Creek Benefication Plant and settling areas. Building, embankment, storage and borrow areas will be cleared only as necessary just prior to construction. Construction run-off will be controlled during heavy rains by collection of run-off in ditches and clarification to remove suspended particulates prior to discharge to Swift Creek.

During construction, heavily trafficked areas will be wetted to control dusting. Roads within the chemical complex will later be paved. Borrow areas that will not be used for mining purposes will be revegetated to reduce erosion. No archeological or historical sites recorded for the State of Florida are located on the site of the proposed project.

(B) Operation

Operation of the proposed Swift Creek Chemical Complex will increase groundwater withdrawals by approximately 3.7 MGD. Measures taken to limit withdrawals from the Floridan Aquifer include production of 98 percent sulfuric acid and recycling of process and nonprocess water.

Monitoring of water levels in observation wells and supply wells will be undertaken to assess the impact of withdrawals and leakage in groundwater quantity.

Discharge of nonprocess water to Swift Creek will increase by approximately 1.6 MGD. Measures taken to reduce nonprocess water discharges include recycling nonprocess water to the sulfuric acid plant cooling tower and to the sulfuric acid plant boilers. Extensive in-plant measures will be implemented to prevent and control contamination of nonprocess water. The proposed action is expected to result in a maximum increase of 206 kg/day of total phosphorus, 147 kg/day of fluoride, 14 kg/day of total nitrogen, and 1470 kg/day of sulfate to Swift Creek. Reduction or elimination of discharges during drought periods will mitigate potential impacts of discharges to surface waters during critical low flows.

Process water will be contained in a pond system designed to maintain a surge capacity equal to 1.5 times the run-off from the 25 year, 24 hour rainfall event. Treatment of process water will be limited to periods of heavy rainfall, i.e., whenever more than 50 percent of the available surge is used.

The gypsum stack-cooling pond will be designed to minimize seepage to the surficial aquifer. Observation wells have been installed to monitor water quality in the surficial aquifer during operation. No measurable impacts are projected on water quality in the Floridan Aquifer. Deep observation wells and water supply wells will be monitored during operation. The earthen dikes of the gypsum stack-cooling pond complex will be inspected routinely during construction and operation to assure proper maintenance.

The air pollutants emitted from the proposed source in significant quantities are sulfur dioxide, particulate matter and fluorides. Sulfur dioxide will be emitted from the two sulfuric acid plants, the auxiliary boiler associated with the sulfuric acid plants and from the heaters associated with the four superphosphoric acid plants. Particulate matter will result from acid mist emissions from the sulfuric acid plants and particulate emissions from fuel fired boilers and the phosphoric acid plant complex. Fluoride emissions will result from the phosphoric acid plant, the superphosphoric acid plants and associated acid clarification facilities. Fluorides will also be emitted from the cooling and gypsum pond. EPA has reviewed the proposed sources and found that air quality standards will not be violated, air quality will not be significantly degraded, and sulfur dioxide and particulate matter emissions will satisfy New Source Performance Standards or Best Available Control Technology.

Given the present disturbed nature of the site, impacts to biological components of the environment will be minimal. Aquatic communities will not be adversely impacted by water discharges from the proposed plant. Impacts to terrestrial biota are associated with air pollutant emissions and water discharges.

Surface water will remain near the radioactivity levels of natural surface waters in the area. Mitigative measures instigated to control seepage from the gypsum stacks will insure that groundwater contamination by radium 226 is not a problem. The proposed chemical plant will process wet unground rock, thereby reducing drying requirements at the existing rock dryers, thereby reducing air-borne radionuclide emissions.

The construction and operation of the proposed Swift Creek Chemical Complex will result in additional employment in Columbia, Hamilton and Suwannee Counties, as well as the State of Florida. Revenue from the collection of state sales and local property taxes are projected to increase based on the proposed expansion and associated growth in population and business. Population growth will result in increased demand for public services and shifts in land use.

4. Alternatives to the Proposed Action:

   A. No-action alternative

   B. Site location alternatives

   C. Process alternatives

   D. Product alternatives

   E. Wastewater treatment alternatives

   F. Air emission abatement alternatives

5. The following Federal, State, and local agencies and interested groups have been requested to comment on this impact statement:

Federal Agencies

Bureau of Outdoor Recreation
Bureau of Mines
Coast Guard
Corps of Engineers
Council on Environmental Quality
Department of Agriculture
Department of Commerce
Energy Research and Development Agency
Federal Highway Administration
Fish & Wildlife Service
Food and Drug Administration
Forest Service
Geological Survey

Department of Health, Education
  and Welfare
Department of the Interior
Department of Transportation
Economic Development Administration
National Park Service
Nuclear Regulatory Commission
Soil Conservation Service

Members of Congress

Honorable Lawton Chiles
United States Senate

Honorable Don Fuqua
U. S. House of Representatives

Honorable Richard Stone
United States Senate

State

Honorable Reuben O'D. Askew
Governor

Bureau of Intergovernmental
  Relations
Coastal Coordinating Council
Dept. of Environmental Regulation
Dept. of Natural Resources
Dept. of Agriculture and
  Consumer Service
Dept. of Administration
Dept. of State
Environmental Regulation
  Committee
Geological Survey
Game and Freshwater Fish
  Commission
Dept. of Commerce
Dept. of Health and
  Rehabilitative Services

Local and Regional

County Commission of Columbia County
County Commission of Hamilton County
County Commission of Suwannee County
North Central Florida Regional Planning Council
Suwannee River Water Mangement District

Interested Groups

Florida Audubon Society
Florida Sierra Club
Florida Defenders of the Environment
Florida Federation of Gardens, Inc.
Florida Trail Association
Florida Wildlife Federation
Florida Conservation Foundation
Florida Lung Association
Columbia County Environmental Council
Hamilton County Chamber of Commerce
Environmental Action Group

The Council of Clean Air
NE Florida Air Conservation Council
Soil and Water Conservation Council
Izaak Walton League
S.A.V.E., Inc.
Suwannee River Coalition
The Fertilizer Institute
Florida Phosphate Council

7. This Draft EIS was made available to the EPA Office of Federal Activities and the public in July, 1978.

Permit No. FL0036226
Application No.

DRAFT

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

JUL 05 1978

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

Occidental Chemical Company
Post Office Box 300
White Springs, Florida 32096

is authorized to discharge from a facility located at

White Springs, Florida

to receiving waters named

001-5, 001-5A, 001-18, 001-18A,
001-22, and 001-28 - all points discharging into Swift Creek.

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective

This permit and the authorization to discharge shall expire at midnight,

DRAFT

Signed

Paul J. Traina
Director
Enforcement Division

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS: Effective when the Section 10 Lake is in use as part of the treatment system.

During the period beginning on effective date and lasting through expiration, the permittee is authorized to discharge from outfall(s) serial numbers 001-5, and 001-18 - combined wastewater stream. Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow-m^3/Day (MGD)	—	—	—	Continuous
Total Suspended Solids	30 mg/1	60 mg/1	2/Week	Composite
Total Phosphorus	—	10 mg/1	2/Week	Composite
Fluoride	—	10 mg/1	2/Week	Composite

Process wastewater that has been treated can be a part of this combined discharge, and then only under the conditions described on page 3.

The pH shall not be less than 5.0 standard units nor greater than 9.0 standard units and shall be monitored continuously.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):

at point of discharge from the Section 10 lake or at 001-5.

A.1. EFFLUENT LIMITATIONS LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date and lasting through expiration, the permittee is authorized to discharge from any and all point sources of process wastewater.

a. There shall be no discharge of process wastewater pollutants to navigable waters.

b. Process wastewater pollutants from a calcium sulfate storage pile runoff facility operated separately or in combination with a water recirculation system designed, constructed and operated to maintain a surge capacity equal to the runoff from the 25 year, 24 hour rainfall event may be discharged, after treatment, whenever chronic or catastrophic precipitation events cause the water level to rise into the surge capacity. Process wastewater must be treated and discharged whenever the water level equals or exceeds the midpoint of the surge capacity.

c. When the Section 10 lake is not used as part of the treatment system, the limitations on pages 4, 5, 6 & 7 are in effect.

A.2.

During the period beginning on the effective date and lasting through expiration, the permittee is authorized to discharge from outfall(s) serial number(s) 001-28, process wastewater, under the conditions described on page 3 of 16. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow-m^3/Day (MGD)	—	—	—	Continuous
Total Phosphorus (as P)	35 mg/l	105 mg/l	*	24-hr composite
Fluoride	25 mg/l	75 mg/l	*	24-hr composite
**Total Suspended Solids	50 mg/l	150 mg/l	*	24-hr composite
Radium 226	—	9 p Ci/l	—	—
***pH range (std. units)				

The effluent limits, and any additional requirements, specified in the attached state certification supersede any less stringent effluent limits listed above. During any time period in which the more stringent state certification effluent limits are stayed or inoperable, the effluent limits above shall be in effect and fully enforceable.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

*The measurement frequency shall be twice per week during periods of discharge, except Radium 226 which shall be monitored once per month.

**The total suspended solids limitations and monitoring requirements set forth above shall be waived for process wastewater from a calcium sulfate storage pile runoff facility operated separately or in combination with a water recirculation system which is chemically treated and then clarified or settled to meet the other effluent limitations established above.

*** pH shall be monitored at outfall(s) serial number(s) 001-5 and 001-18.

A. 3. During the period beginning on the effective date and lasting through expiration, the permittee is authorized to discharge from outfall(s) serial number(s) 001-22, contaminated non-process wastewater. This discharge shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations kg/day(lbs/day)		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow-m^3/day (MGD)	—	—	—	Continuous
Total Phosphorus (as P)	35 mg/1	105 mg/1	2/Week	24-hr composite
Fluoride	25 mg/1	75 mg/1	2/Week	24-hr compostie
*pH range (std. units)				

The effluent limits, and any additional requirements, specified in the attached state certification supersede any less stringent limits listed above. During any time period in which the more stringent state certification effluent limits are stayed or inoperable, the effluent limits listed above shall be in effect and fully enforceable.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

* pH shall be monitored at Outfalls 001-5 and 001-18.

A.4. During the period beginning on the effective date and lasting through expiration, the permittee is authorized to discharge from outfall(s) serial number(s) 001-5 and 001-18, combined wastewater stream. This discharge shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Minimum	Maximum	Measurement Frequency	Sample Type
pH range (std. units)	5.0	9.0	——	Continuous

The effluent limits and any additional requirements specified in the attached state certification supersede any less stringent effluent limits listed above. During any time period in which the more stringent state certification effluent limits are stayed or inoperable, the effluent limits listed above shall be in effect and fully enforceable.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):

Nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

A.5. During the period beginning on effective date and lasting through expiration, the permittee is authorized to discharge from outfall(s) serial numbers 001-5A and 001-18A - Mining Effluent. Such discharges shall be limited and monitored by thepermittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow-m^3/Day (MGD)	———	———	———	Continuous
Total Suspended Solids	30 mg/1	60 mg/1	2/Week	Composite

The effluent limits and any additional requirements specified in the attached state certification supersede any less stringent effluent limits listed above. During any time period in which the more stringent state certification effluent limits are stayed or inoperable, the effluent limits listed above shall be in effect and fully enforceable.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 2/Week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):

> at the nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

9. For the purpose of this permit:

   a. The term "process wastewater" means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, by-product, or waste product. The term "process wastewater" does not include contaminated non-process wastewater, as defined below.

   b. The term "contaminated non-process wastewater" shall mean any water including precipitation runoff which, during manufacturing or processing, comes into incidental contact with any raw material, intermediate product, finished product, by-product or waste product be means of: (1) precipitation runoff; (2) accidental spills; (3) accidental leaks caused by the failure of process equipment and which are repaired or the discharge of pollutants therefrom contained or terminated within the shortest reasonable time which shall not exceed 24 hours after discovery or when discovery should reasonably have been made, whichever is earliest; and (4) discharges from safety showers and related personal safety equipment and from equipment washings for the purpose of safe entry, inspection and maintenance; provided that all reasonable measures have been taken to prevent, reduce, eliminate and control to the maximum extent feasible such contact and provided furtherthat all reasonable measures have been taken that will mitigate the effects of such contact once it has occurred.

   c. The term "twenty-five year, 24 hour rainfall event" shall mean the maximum 24 hour precipitation event with a probable recurrence interval of once in twenty-five years as defined by the National Weather Service in technical paper No. 40, "Rainfall Frequency Atlas of the United States," May, 1961, and subsequent amendments in effect as of the effective date of this regulation.

   d. The term "calcium sulfate storage pile runoff" shall mean the calcium sulfate transport water runoff from or through the calcium sulfate pile, and the precipitation which falls directly on the storage pile and which may be collected in a seepage ditch at the base of the outer slopes of the storage pile, provided such seepage ditch is protected from the incursion of surface runoff from areas outside of the outer perimeter of the seepage ditch.

   e. The term "daily average concentration" means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample.

f. The term "daily maximum concentration" means the daily determination of concentration for any calendar day.

g. The term "weighted by flow value" means the summation of each sample concentration multiplied by its respective flow divided by the sum of the respective flows.

h. For the purpose of this permit, a calendar day is defined as any consecutive 24-hour period.

i. The term "mining effluent" shall mean any water that is impounded or that collects in the mine and is pumped, drained, or otherwise removed from the mine through the efforts of the mine operator. However, if a mine is also used for the treatment of process generated wastewater, discharges of commingled water from the mine shall be deemed discharges of process generated wastewater.

j. The term "mine" shall mean an area of land, surface or underground, actively used for or resulting from the extraction of a mineral from natural deposits.

k. The term "process generated wastewater" shall mean any wastewater used in the slurry transport of mined material, air emissions control, or processing exclusive of mining. The term shall also include any other water which becomes commingled with such wastewater in a pit, pond, lagoon, mine, or other facility used for settling or treatment of such wastewater.

B. SCHEDULE OF COMPLIANCE

1. **The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:**

   Compliance shall be achieved on the first day of discharge.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

C. MONITORING AND REPORTING

1. *Representative Sampling*

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. *Reporting*

Monitoring results obtained during the previous quarter shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on . Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

Environmental Protection Agency
Water Enforcement Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30308

Florida Dept. of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301

3. *Definitions*

a. The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

b. The "daily maximum" discharge means the total discharge by weight during any calendar day.

4. *Test Procedures*

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. *Recording of Results*

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. *Additional Monitoring by Permittee*

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

7. *Records Retention*

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State water pollution control agency.

A. MANAGEMENT REQUIREMENTS

1. *Change in Discharge*

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. *Noncompliance Notification*

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. *Facilities Operation*

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. *Adverse Impact*

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. *Bypassing*

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

6. *Removed Substances*

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

7. *Power Failures*

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power source is not in existence, and no date for its implementation appears in Part I,

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. *Right of Entry*

The permittee shall allow the head of the State water pollution control agency, the Regional Administrator, and/or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

2. *Transfer of Ownership or Control*

In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency.

3. *Availability of Reports*

Except for data determined to be confidential under Section 308 of the Act, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. *Permit Modification*

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. *Toxic Pollutants*

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. *Civil and Criminal Liability*

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. *Oil and Hazardous Substance Liability*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. *State Laws*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. *Property Rights*

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. *Severability*

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

OTHER REQUIREMENTS

1. If corrective action is required under the provisions of Part III, 1.A. & 1.B. of NPDES Permit #FL0000655, Occidental will modify the gypsum storage and cooling pond facilities serving this plant to conform to the program resulting from Part III, 1.B., Permit #FL0000655.

2. Additional Conditions for "Removed Substances", (Part II, Sect. A, Para. 6)

   Within 180 days of anticipated gypsum pile abandonment, the permittee shall submit a plan for the elimination of the discharge of pollutants from the gypsum pile upon abandonment. Such plan for the elimination of the discharge of pollutants to the extent practicable shall specify the action the permittee will take with respect to the regrading of the gypsum pile.

3. State Certification - The State of Florida Department of Environmental Regulation has certified the discharge(s) covered by this permit with conditions (Attachment I). Section 401 of the Act requires that conditions of certification shall become a condition of the permit. The monitoring and sampling shall be as indicated for those parameters included in the certification. In the event of any conflict between the conditions of this permit and in the certification attached, the more restrictive shall rule.

United States
Environmental Protection
Agency

Region 4
345 Courtland Street, NE
Atlanta, GA 30308

EPA 904/9-78-012
JULY 1978

EPA

Environmental Impact Statement

DRAFT

Occidental Chemical Company
Swift Creek Chemical Complex
Hamilton County, Florida

Summary Document

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SECTION 1.0

DESCRIPTION OF THE PROPOSED NEW SOURCE

This environmental impact statement (EIS) was prepared by the Region IV office of the Environmental Protection Agency (EPA).

The purpose of this statement is to fulfill the requirements of the National Environmental Policy Act (NEPA) and the resulting EPA, January 11, 1977 regulations; viz: Preparation of Environmental Impact Statements for New Source NPDES Permits (40 CFR 6.900).

This is a site specific EIS which has evaluated the impact of a proposed expansion of a phosphate fertilizer processing facility in North Florida.

The proposed plant will be located adjacent to an existing phosphate mine and beneficiation plant and will upgrade phosphate rock to a high analysis liquid phosphate for agricultural use.

Both primary impacts and secondary impacts have been reviewed to determine the effect of the expansion on the present environment.

1.1 OVERVIEW

The applicant, Occidental Chemical Company (Occidental) is a member of the Agricultural Products Group of the Hooker Chemical Corporation, a subsidiary of Occidental Petroleum Corporation.

The Florida operation of Occidental, located in Hamilton County, north of White Springs, Florida, is one of many fertilizer grade phosphate rock processing complexes in the State of Florida.

Occidental desires to increase the capacity of its North Florida Complex. This development will provide fertilizer-grade phosphates by upgrading phosphate rock and concentrating to high analysis liquid phosphate known as superphosphoric acid (SPA).

The expansion is planned for a site adjacent to the existing Swift Creek Mine located five miles west of the Suwannee River Chemical Complex.

The facility will require approximately 50 acres for plant and 275 acres each for a cooling pond and by-product gypsum storage, and will further involve small acreage for utilities and transportation rights-of-way. The project is located mainly in Section 36, Township 1 North, Range 14 East.

The superphosphoric acid product (SPA) will be shipped and become part of a balanced fertilizer produced near the user. In return, the SPA will be traded for natural gas products -- ammonia and urea -- and potash in connection with a Global Agreement with the U.S.S.R.

To satisfy the agreement, facilities will be constructed in two phases. Each will produce approximately half the SPA required.

Phase I (as an "existing source"), is currently in construction at the Suwannee River Chemical Complex and will be complete in late 1978. This phase provides for diversion of part of the existing phosphoric acid capacity from granular fertilizers to SPA.

Needed facilities include phosphoric acid clarification and evaporators to remove water and concentrate to SPA.

Phase II (as a "new source"), is proposed for the Swift Creek mine site and is planned for completion in late 1979. This phase provides for manufacture of sulfuric acid and combination with phosphate rock to produce phosphoric acid.

Needed facilities will also include phosphoric acid clarification and evaporators to remove water and concentrate to SPA.

The Phase II expansion addressed herein is expected to result in the trade of approximately 0.5 million metric tons per year SPA for 0.75 million metric tons per year of ammonia, 0.5 million metric tons per year of urea, and 0.5 million metric tons per year of potash. The overall energy trade is favorable to the United States.

1.2 SUMMARY OF EXISTING FACILITIES

Occidental is the only company presently mining and processing phosphate in northern Florida. The operation which began in 1964 is situated on reserves encompassing an area of approximately 144,000 acres. There are two phosphate rock plants and one chemical complex: the Swift Creek Mine, the Suwannee River Mine and the Suwannee River Chemical Complex.

The Suwannee River Mine started in 1964; Swift Creek Mine in December, 1975. Each mine has the capacity to produce about 2.5 million tons of phosphate rock concentrate per year.

The mining and recovery of phosphate is a process of removing phosphate ore (matrix) from the ground by draglines and transporting it hydraulically to the beneficiation plants where the clays (approximately 23 percent) and sand (approximately 57 percent) are screened and removed. The remaining (approximately 20 percent) phosphate concentrate is stored aboveground and graded according to the quality of the material.

Florida law requires reclamation of mined lands. Approximately 6000 acres have been mined by Occidental since 1964 and the majority of the land is in use as water storage, cooling ponds, clay settling and plant sites. The remainder of the land has been, or is in the process of being, reclaimed.

The existing Suwannee River Chemical Complex started in 1966 and was expanded in 1975. This operation uses approximately two-thirds of the Suwannee River Mine production for the chemical upgrading of the rock into products for agriculture, chiefly high-analysis fertilizers. The chemical processing is necessary to convert the phosphate into a form that is available to plant life.

Wet phosphate rock is carried to the Suwannee River Chemical Complex by conveyor and reacted with sulfuric acid, filtered to remove a calcium sulfate (gypsum) by-product, and evaporated to form a concentrated phosphoric acid. This material is sold as a "merchant grade" liquid fertilizer or further processed to a granular, high-analysis fertilizer called triplesuperphosphate (TSP). Another granular product is produced by the reaction of ammonia with the phosphoric acid and granulated to form diammonium phosphate (DAP). A third granular product is produced by a process that calcines phosphate rock into a form suitable for use as an animal feed supplement.

A facility currently in construction provides for diversion of part of the existing phosphoric acid capacity from the above products to SPA. Thus, equipment for acid clarification, concentration, storage and loading of SPA will be complete in late 1978.

The facilities now employ approximately 1100 people. The plants operate on a twenty-four hour, seven-day-a-week schedule to ship products to domestic and overseas customers.

1.3 SUMMARY OF NEW SOURCE (PHASE II)

The new facilities will be capable of producing and shipping 500,000 metric tons per year of SPA. The SPA will contain 68-70 percent P_2O_5 (i.e. 350,000 metric tons per year of P_2O_5), with 25-40 percent conversion of total P_2O_5 to polyphosphates. This product will be used to produce stable solutions of balanced liquid fertilizers near the user.

Process units and related facilities will include:

- conveying of wet phosphate rock between existing mine and new processing plant,
- manufacture of sulfuric acid and combination with phosphate rock to produce phosphoric acid,
- clarification of phosphoric acid,
- evaporation of phosphoric acid to SPA, and
- storage, loading and shipping of SPA.

This complex will produce up to 4,000 short tons per day of sulfuric acid as an intermediate product in the production of 1,400 short tons per day of P_2O_5 as SPA.

By-product steam from the burning of sulfur to produce sulfuric acid will be used to generate 60 percent of the electric power to run the complex.

By-product gypsum will be stored in an impoundment serving a dual purpose as an evaporative cooling pond.

The development will be self-contained for sewage treatment, fire protection, potable water, storm drainage and garbage disposal.

Process water will be contained in a pond system designed, constructed, and operated to maintain a surge capacity equal to the run-off from the 25-year, 24-hour rainfall event. When chronic or catastrophic precipitation cause the water level to equal or exceed the midpoint of the surge capacity, process waters will be treated at a neutralization station to meet U.S. Environmental Protection Agency guidelines, 40 CFR, Section 418.15(c). Nonprocess waters, with rainfall run-off, will meet 40 CFR, 418.15(d).

1.4 DESCRIPTION OF EXISTING AND PROPOSED FACILITIES

1.4.1 EXISTING FACILITIES

Detailed descriptions of the existing facilities -- Swift Creek Mine, Suwannee River Mine, and Suwannee River Chemical Complex and Phase I Expansion -- are contained in the Appendix of the Occidental Chemical Company EIS Resource Document (Resource Document). Phase I expansion of the Suwannee River Chemical Complex is now under construction.

1.4.2 SWIFT CREEK CHEMICAL COMPLEX PROPOSED FACILITIES -- PHASE II EXPANSION ALTERNATE 1: DIHYDRATE WET PROCESS PHOSPHORIC ACID PLANT

Engineering for the proposed Swift Creek Chemical Complex, Phase II of the Russian SPA project, was started in April 1978; start of site preparation activities are scheduled for the summer of 1978; and plant start-up is scheduled for October 1979. Two alternate wet process phosphoric acid processes are being considered. Alternate 1 (herein described) would use a conventional dihydrate process, and Alternate 2 would use a new proprietary Occidental hemihydrate process, as described in Section 4.3.2 of this document and in Section 4.3.3 of the Resource Document.

Location of the proposed Swift Creek Chemical Complex (SCCC) will be in Hamilton County in North Florida, north of White Springs, Florida, east of U.S. Highway 41 between White Springs and Jasper, Florida, and adjacent to the Swift Creek Mine (SCM) as shown on Figure 1.4-1, Area Location Map. UMT coordinates are 320,860 East, 3,369,750 North.

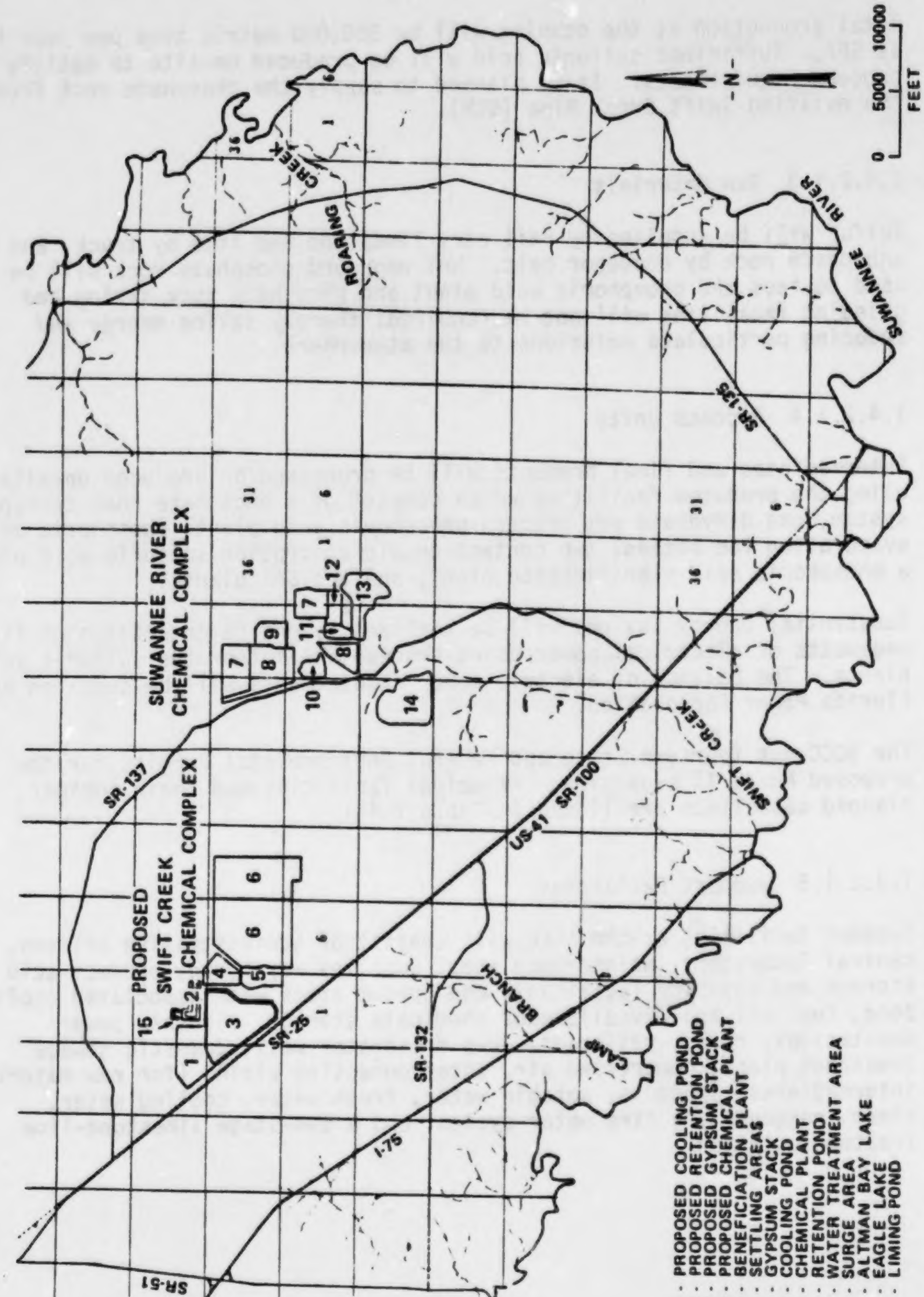
A detailed description of the proposed SCCC is contained in Section 1.4 of the Resource Document. The Appendix to Section 1.0 of that document also contains a detailed description of the existing Swift Creek Mine (which is about five miles west of the existing Suwannee River Chemical Plant and Mine), and the existing Suwannee River Chemical Complex and Mine.

The chemical complex site will be adjacent to the beneficiation plant of the existing Swift Creek Mine. Site requirements are approximately 50 acres for the chemical plant and 550 to 600 acres for the gypsum stack and cooling ponds with further small acreage for utilities and transportation rights-of-way.

1.4.2.1 Chemical Plant Description

1.4.2.1.1 Products

Final products shipped from the SCCC will consist of 70 percent P_2O_5 superphosphoric acid (SPA) and a small amount of sulfuric acid. SPA will be shipped by rail car and sulfuric acid by rail car and truck.


PROPOSED SWIFT CREEK CHEMICAL COMPLEX
SUWANNEE RIVER CHEMICAL COMPLEX
SR-51
SR-137
SR-25
SR-132
I-75
US-41
SR-100
SR-136
CAMP BRANCH
SWIFT CREEK
ROARING CREEK
SUWANNEE RIVER
36
31
6
1
-N-
0
5000
10000
FEET
1 . . PROPOSED COOLING POND
2 . . PROPOSED RETENTION POND
3 . . PROPOSED GYPSUM STACK
4 . . PROPOSED CHEMICAL PLANT
5 . . BENEFICIATION PLANT
6 . . SETTLING AREAS
7 . . GYPSUM STACK
8 . . COOLING POND
9 . . CHEMICAL PLANT
10 . . RETENTION POND
11 . . WATER TREATMENT AREA
12 . . SURGE AREA
13 . . ALTMAN BAY LAKE
14 . . EAGLE LAKE
15 . . LIMING POND

AREA LOCATION MAP—OCCIDENTAL CHEMICAL COMPANY

FIGURE 1.4-1

1.4.2.1.2 Capacity

Total production at the complex will be 350,000 metric tons per year P_2O_5 as SPA. Sufficient sulfuric acid will be produced on-site to satisfy process requirements. It is planned to supply the phosphate rock from the existing Swift Creek Mine (SCM).

1.4.2.1.3 Raw Materials

Sulfur will be supplied by rail car, limestone and lime by truck, and phosphate rock by conveyor belt. Wet unground phosphate rock will be used to feed the phosphoric acid plant and phosphate rock drying and grinding facilities will not be required; thereby saving energy and reducing particulate emissions to the atmosphere.

1.4.2.1.4 Process Units

Intermediates and final products will be processed or produced on-site using the proposed facilities which consist of a phosphate rock transport system, one dihydrate wet process phosphoric acid plant, phosphoric acid evaporation facilities, two contact double absorption sulfuric acid plants, a phosphoric acid clarification plant, and two SPA plants.

Substantial energy savings will be realized by onsite generation of 11.2 megawatts of electrical power using process steam from the sulfuric acid plants. The balance of electric power requirements will be supplied by Florida Power Corporation.

The SCCC has fourteen State and Federal Environmental Permits for the proposed Phase II expansion. Principal facilities and their nominal planned capacities are listed in Table 1.4-1.

1.4.2.1.5 Support Facilities

Support facilities at the SCCC will consist of administrative offices, a central laboratory, maintenance shop, supplies warehouse, product acid storage and shipping facilities, one gypsum stack with associated cooling pond, fuel oil and miscellaneous chemicals storage, electric power substations, roads, railroads, deep freshwater well, domestic sewage treatment plant, compressed air, interconnecting piping (for raw materials, intermediates, products, potable water, fresh water, cooling water, steam, reagents), a fire water system, and a two-stage limestone-lime treatment station.

Table 1.4-1 Process Plants and Support Facilities

Name	Process Units Type	Nominal Capacity
Sulfuric Acid Plants E&F	Sulfur Burning Double Absorption Contact Type, 98% Acid, Water Treatment, Aux. Boiler	2,000 STPD each
Phosphate Rock Transport	Conveyor Belt & Storage Bin	280 STPH Wet Rock
Phosphoric Acid Plant D	Wet Process Dihydrate Type Using Wet Unground Phosphate Rock and 98% Sulfuric Acid	1400 STPD P_2O_5 as 30% P_2O_5 acid
27%-54% P_2O_5 Evaporation and Clarification	Forced-Circulation Type Steam Heated Phosphoric Acid Evaporators	1400 STPD P_2O_5 as 54% P_2O_5 acid
Superphosphoric Acid Plants C&D	Forced-Circulation Type Steam Heated Superphosphoric Acid Evaporators	1400 STPD P_2O_5 as 70% P_2O_5 acid
SPA Storage & Shipping	Two Acid Storage Tanks and Rail Shipping System	24,000 Metric Tons Acid Total
Electric Power Generation	Steam Turbine-Generator Using Sulfuric Acid Plant Process Steam	11.2 Megawatts

Table 1.4-1 continued
Page Two

Name	Support Facilities Type	Nominal Capacity
Gypsum Stack & Cooling Pond	Above and/or Below Ground Gypsum Stack and Cooling Pond	550 to 600 Acres Total Rainfall Catchment & 230 to 250 Wet Acres for Evaporation
Process Water Treatment System	Two-stage Limestone-lime Neutralization System with Settler and Two Settling Ponds	2,000 GPM Pond Water
Nonprocess Water System	Fresh Water Ditch No. 1 to Surge Pond to Fresh Water Ditch No. 2 to Section 10 Pond	Surge Pond - 30 Acres x 20 ft. Deep
Domestic Water Treatment System	Extended Aeration Followed by Chlorination	25,000 GPD - 180 Population
Deep Well	Vertical Fresh Water Well - 800 ft. Casing	7,000 GPM
General	Office Building, Laboratory, Maintenance Shop, Warehouse, Roads, Electrical Substations, Railroads, Compressed Air, Water Systems (Potable, Process, Pond, Fire), Interconnecting Piping, etc.	-

1.4.2.1.6 Water Use and Discharge

Proposed Swift Creek Chemical Complex: One 7,000 GPM freshwater well at a depth of about 800 feet will supply all process and nonprocess water for the complex. The well will be installed in parallel with two existing 7,000 GPM Swift Creek Mine wells and will also supply water to the SCM. One 500 GPM potable water well at a depth of about 300 feet will supply all potable water uses. Treated domestic water will be discharged to the Swift Creek Mine water circuit.

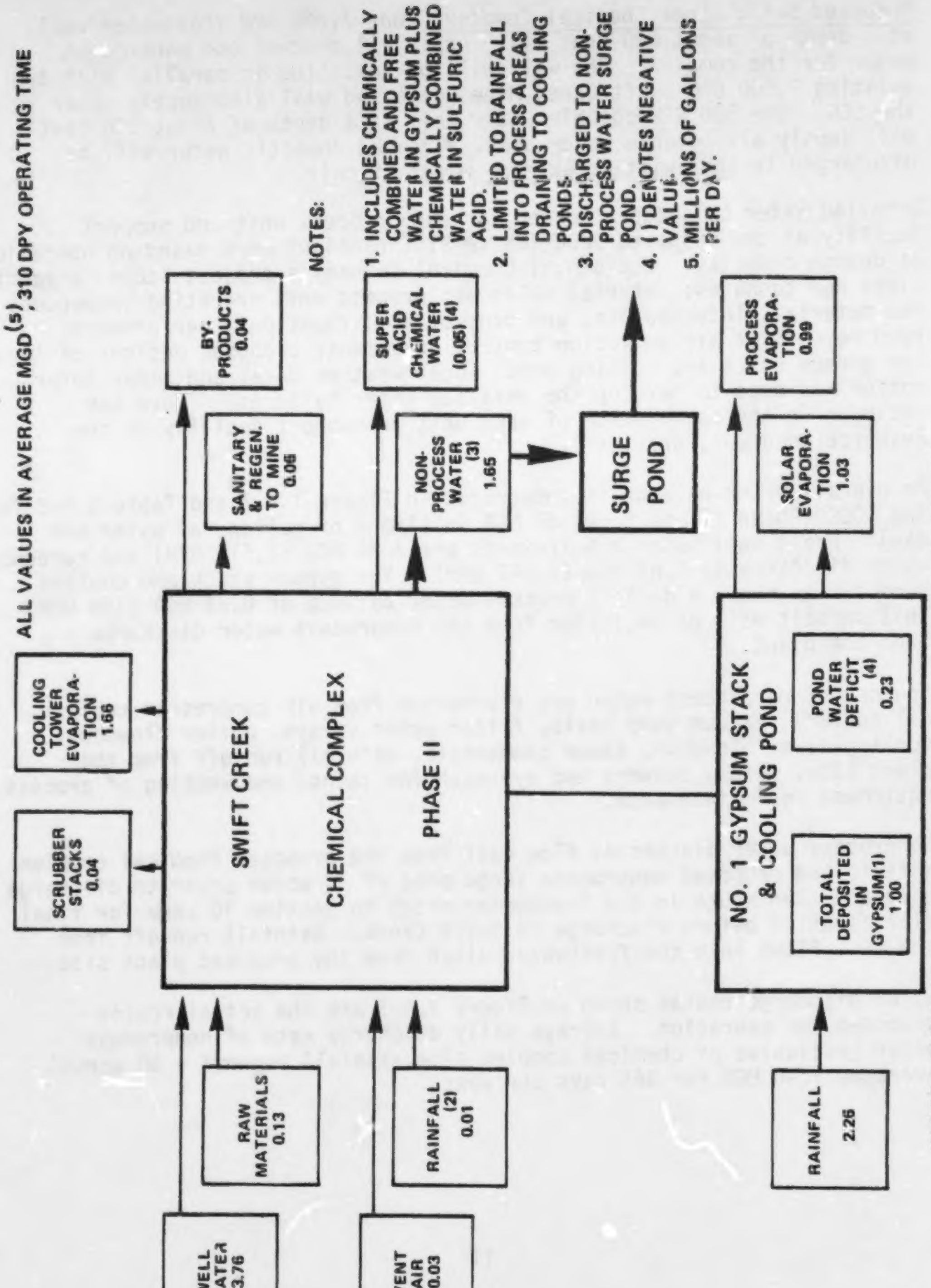
Detailed water balances prepared for each process unit and support facility of the proposed SCCC (Phase II Expansion) were based on operation at design capacity. Occidental Chemical Company's project scope; product slate and tonnages; material balances; process unit operating sequences; raw material, intermediate, and product specifications; performance requirements of air pollution control equipment; proposed designs of the gypsum stack and cooling pond; local weather data; and other information was used to develop the detailed water balances. These are included in the description of each unit or support facility in the Resource Document, Section 1.4.

An overall water balance is summarized in Figure 1.4-2 and Table 1.4-2 for the SCCC (Phase II) in terms of MGD (millions of gallons of water per day). Fresh well water requirements are 3.76 MGD (2,611 GPM) and nonprocess water discharge is 1.65 MGD (1,142 GPM). The gypsum stack and cooling pond system shows a deficit process water balance of 0.23 MGD (158 GPM). This deficit will be satisfied from the nonprocess water discharge from the plant.

Sources of nonprocess water are discharges from air compressor coolers, oil coolers, vacuum pump seals, filter skirt sprays, boiler blowdown, cooling tower blowdown, steam condensate, rainfall run-off from the plant site, safety showers and eye wash fountains, and washing of process equipment for maintenance.

Nonprocess water discharges flow east from the proposed chemical complex site to the proposed nonprocess surge pond of 30 acres prior to discharge east and then south in the freshwater ditch to Section 10 Lake for final clarification before discharge to Swift Creek. Rainfall run-off from the SCCC flows into the freshwater ditch from the proposed plant site.

Water discharge routes shown on Figure 1.4-3 are the actual routes proposed for operation. Average daily discharge rate of nonprocess water (exclusive of chemical complex site rainfall run-off - 50 acres) averages 1.40 MGD for 365 days per year.


WELL WATER 3.76
RAW MATERIALS 0.13
VENT AIR 0.03
RAINFALL (2) 0.01
SCRUBBER STACKS 0.04
COOLING TOWER EVAPORATION 1.66
SWIFT CREEK CHEMICAL COMPLEX PHASE II
SANITARY & REGEN. TO MINE 0.06
BY-PRODUCTS 0.04
NON-PROCESS WATER (3) 1.65
SUPER ACID CHEMICAL WATER (0.05) (4)
SURGE POND
PROCESS EVAPORATION 0.99
RAINFALL 2.26
NO. 1 GYPSUM STACK & COOLING POND
TOTAL DEPOSITED IN GYPSUM(1) 1.00
POND WATER DEFICIT (4) 0.23
SOLAR EVAPORATION 1.03

ALL VALUES IN AVERAGE MGD$^{(5)}$, 310 DPY OPERATING TIME

NOTES:

1. INCLUDES CHEMICALLY COMBINED AND FREE WATER IN GYPSUM PLUS CHEMICALLY COMBINED WATER IN SULFURIC ACID.
2. LIMITED TO RAINFALL INTO PROCESS AREAS DRAINING TO COOLING PONDS.
3. DISCHARGED TO NON-PROCESS WATER SURGE POND.
4. ( ) DENOTES NEGATIVE VALUE.
5. MILLIONS OF GALLONS PER DAY.

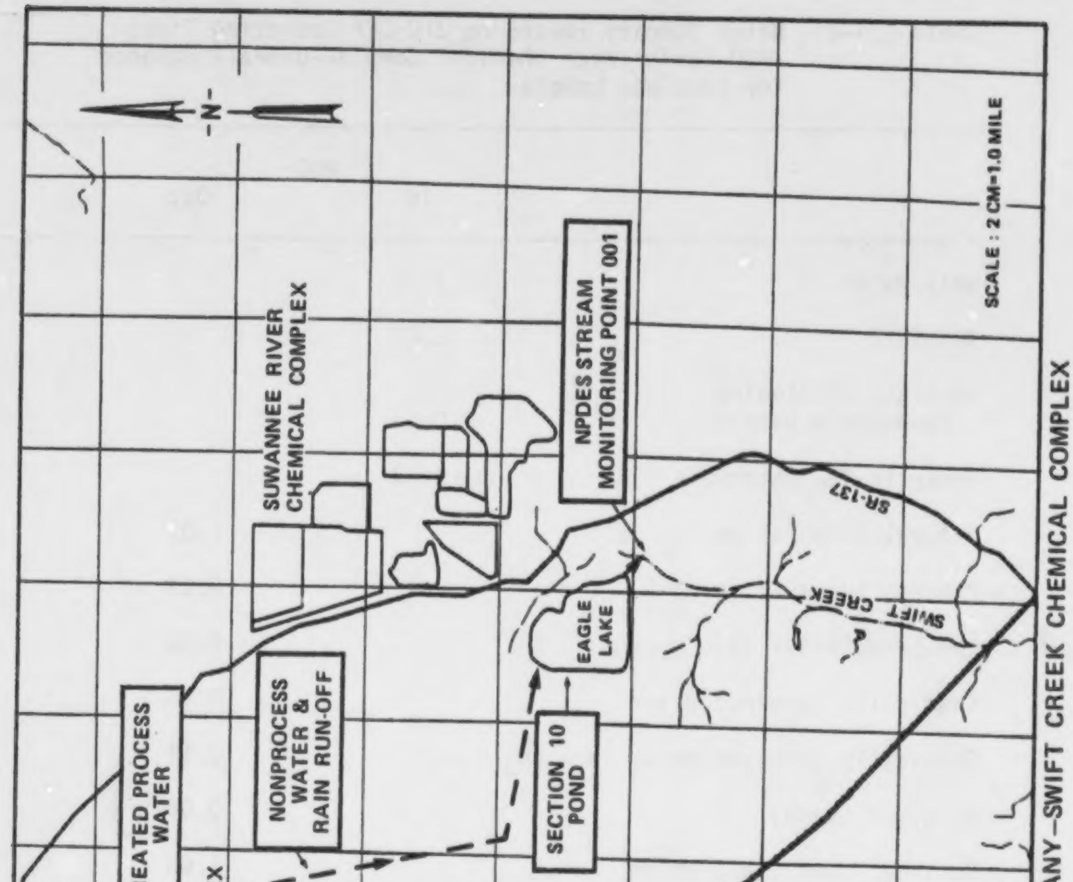
WATER SUMMARY – MGD SWIFT CREEK CHEMICAL COMPLEX

FIGURE 1.4-2

Table 1.4-2 Water Summary (Based on 310 DPY Operating Time) -MGD-Swift Creek Chemical Complex-Overall Balance for Complete Complex

	MGD In	MGD Out
Well Water	3.76	
Rainfall	2.27	
Vent Air (Including Combustion Water)	0.03	
Water in Raw Materials	0.13	
Natural Evaporation		1.03
Process Evaporation		0.99
Deposited Water with Gypsum		0.53
Chemically Combined Water		0.25
Chemically Combined Water in H_2SO_4		0.17
Scrubber Stacks		0.04
Cooling Tower Evaporation		1.66
Water in Products & By-products		0.04
Nonprocess Water(1)		1.65
Sanitary & Regeneration Water to Mine Water		0.06
Deficit: Gypsum Stack & Cooling Pond	0.23	
Total Overall Balance on Complete Complex:	6.42	6.42

(1) To freshwater ditch; see individual process units for description--excludes rainfall run-off.


N
SCALE : 2 CM=1.0 MILE
SUWANNEE RIVER CHEMICAL COMPLEX
NPDES STREAM MONITORING POINT 001
TREATED PROCESS WATER
NONPROCESS WATER & RAIN RUN-OFF
SECTION 10 POND
EAGLE LAKE
SR-137
SWIFT CREEK
PROPOSED SWIFT CREEK CHEMICAL COMPLEX
LIMING POND
RETENTION POND
SR-100 SR-41 SR-25
SR-132
I-75
SUWANNEE RIVER

WATER SYSTEMS–OCCIDENTAL CHEMICAL COMPANY–SWIFT CREEK CHEMICAL COMPLEX

FIGURE 1.4-3

Process water discharge is not expected unless excessive rainfall occurs. If discharged, process water would be treated by a two-stage neutralization system using limestone and lime and settled in a settler and settling ponds. Discharge of treated water would then flow from the east end of the settling pond to intercept the freshwater ditch or to the Swift Creek Mine water circuit.

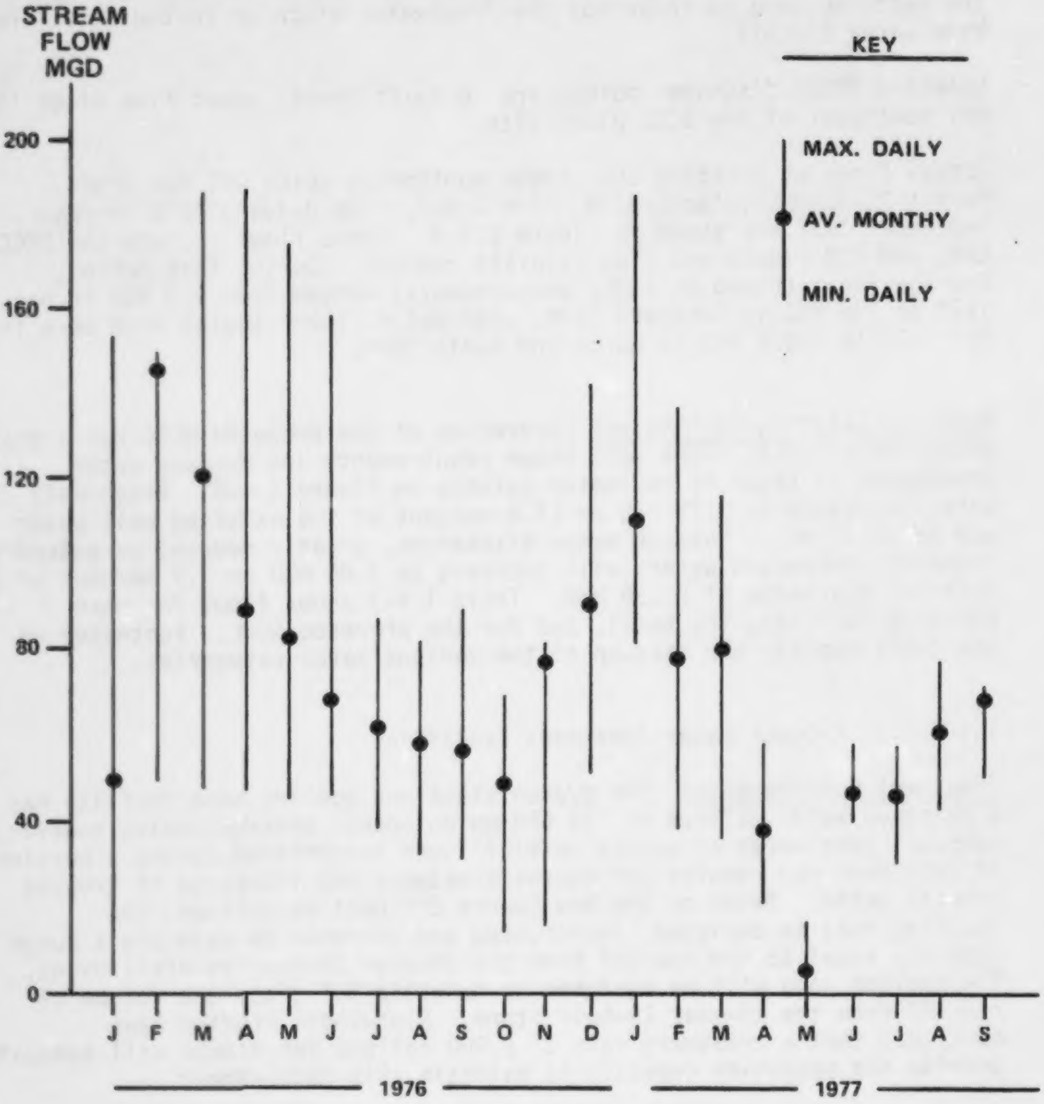
Existing NPDES discharge points are to Swift Creek, about five miles (8.3 km) southeast of the SCCC plant site.

Actual flows at existing EPA stream monitoring point 001 for NPDES Permit FL-0000655, located in Swift Creek, from January 1976 through September 1977 are shown in Figure 1.4-4. These flows include the SRCC, SRM, and SCM discharges plus rainfall run-off. During this period, average flows (based on daily measurements) ranged from 4.0 MGD in May 1977 to 146 MGD in February 1976, with daily flows ranging from zero in May 1977 to 188.5 MGD in March and April 1976.

SCCC Vs. Existing Facilities: Operation of the proposed SCCC has a small effect on existing fresh well water requirements and surface water discharges as shown by the water balance on Figure 1.4-5. Fresh well water increases by 3.76 MGD or 11.8 percent of the existing well water use of 31.82 MGD. Surface water discharges, greatly reduced by extensive reuse of nonprocess water, will increase by 1.65 MGD or 7.7 percent of the existing discharge of 21.36 MGD. Table 1.4-3 shows flows for each existing facility, the total, and for the proposed SCCC. Footnotes on the table explain the make-up of the various water categories.

1.4.2.1.7 Process Water Treatment Facilities

Treatment Requirements: The gypsum stack and cooling pond facility has a negative water balance of 158 GPM on an annual average basis; however, seasonal imbalances of excess rainfall over evaporation during a portion of each year may require infrequent treatment and discharge of treated process water. Based on the New Source Effluent Guidelines, the facility must be designed, constructed and operated to maintain a surge capacity equal to the run-off from the 25-year 24-hour rainfall event. The cooling pond will be designed to maintain 1.5 times the volume of run-off from the 25-year 24-hour storm. Hydrologic studies have concluded that a treatment rate of 2,000 gallons per minute will adequately provide the necessary capacity to maintain this requirement.



STREAM FLOW, MGD AT STREAM MONITORING POINT 001

FIGURE 1.4-4

WATER BALANCE-PROPOSED vs. EXISTING
MGD (MILLIONS GALLONS PER DAY)

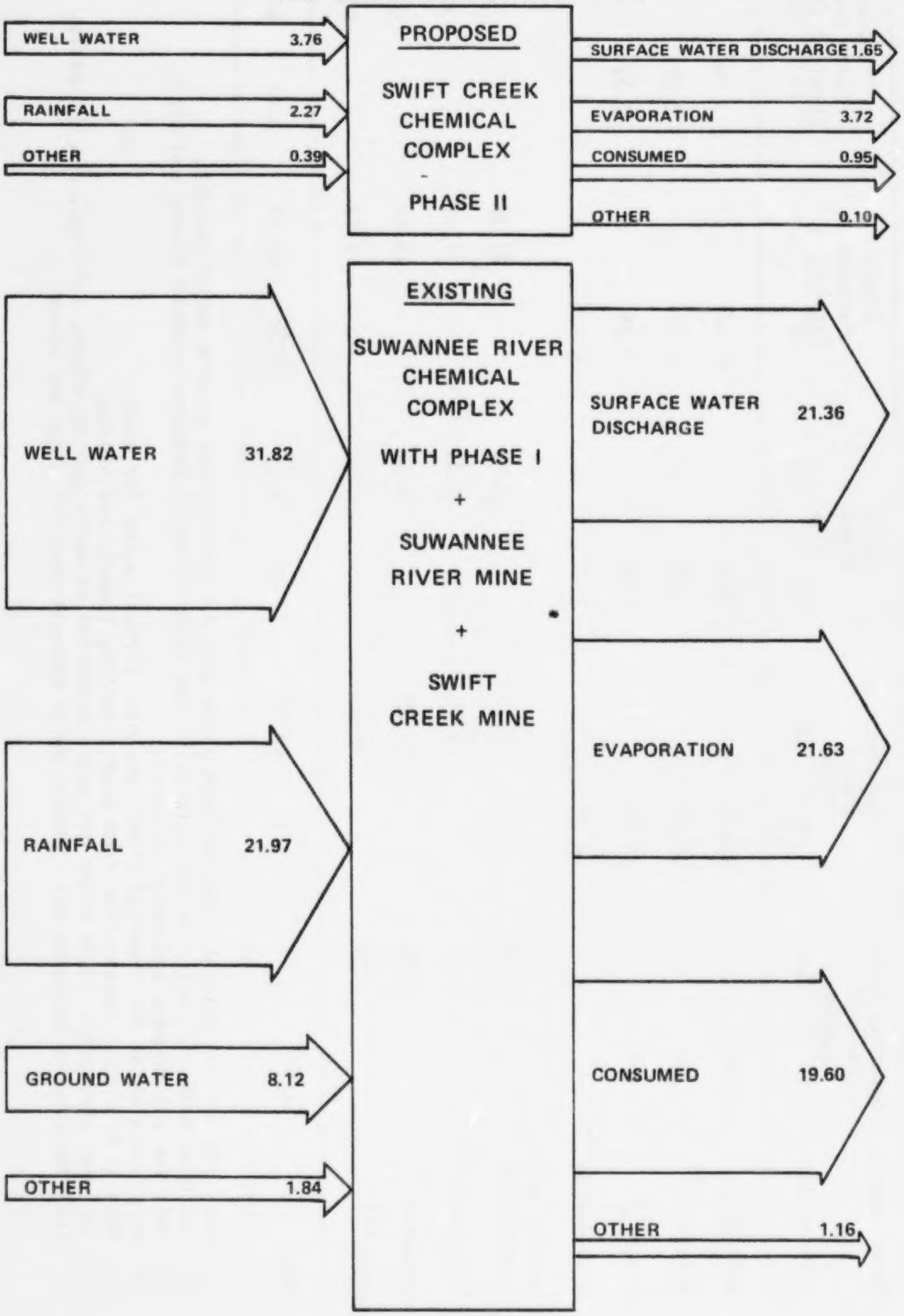

WELL WATER 3.76
RAINFALL 2.27
OTHER 0.39
PROPOSED
SWIFT CREEK CHEMICAL COMPLEX - PHASE II
SURFACE WATER DISCHARGE 1.65
EVAPORATION 3.72
CONSUMED 0.95
OTHER 0.10
WELL WATER 31.82
RAINFALL 21.97
GROUND WATER 8.12
OTHER 1.84
EXISTING
SUWANNEE RIVER CHEMICAL COMPLEX WITH PHASE I + SUWANNEE RIVER MINE + SWIFT CREEK MINE
SURFACE WATER DISCHARGE 21.36
EVAPORATION 21.63
CONSUMED 19.60
OTHER 1.16

FIGURE 1.4-5

Table 1.4-3 Water Balance--Existing vs. Proposed Facilities (MGD)

Water Source or Termination	Suwannee River Chemical Complex		Suwannee River Mine		Swift Creek Mine		Total Existing Facilities		Proposed Swift Creek Chemical Complex	
	In	Out	In	Out	In	Out	In	Out	In	Out
Well Water	12.00		10.15		9.67		31.82		3.76	
Rainfall(1)	3.20		14.89		3.88		21.97		2.27	
Other(2)	1.57		0.18		0.09		1.84		0.39	
Groundwater(3)	-		4.20		3.92		8.12		-	
Surface Water Discharge(4)		8.31		8.40		4.65		21.36		1.65
Evaporation(5)		6.35		11.35		3.93		21.63		3.72
Consumed(6)		1.64		9.09		8.87		19.60		0.95
Other(7)		0.47		0.58		0.11		1.16		0.10
Total	16.77	16.77	29.42	29.42	17.56	17.56	63.75	63.75	6.42	6.42

(1) Does not include rainfall run-off from plant area or area outside of mine water circuit.
(2) Includes vent air, water in raw materials, and transfer water between chemical plants and mines.
(3) Includes pit seepage and water in matrix.
(4) Nonprocess water for chemical plants and mine circuit water for mines.
(5) Natural & process evaporation from ponds, cooling towers, and stacks.
(6) Includes chemically bound water and water deposited in waste gypsum, clays, tailings, and mud balls.
(7) Includes product moisture and transfer water between chemical plant and mines.

A chemical analysis of the process water within the impoundment expected for the SCCC, based on Occidental's existing SRCC operation is shown in Table 1.4-4. These values vary widely on a seasonal basis as influenced by the amount of rainfall. Process water chemical analysis varies with the phosphate rock processed and the chemical processes used. There is no typical analysis in the phosphate industry.

Treatment Facilities: Latest available technology for treatment of process water is generally referred to as "double liming". Two-stage neutralization ("double liming") has proven to be the most effective process for treatment of process water and has been established as the Best Available Demonstrated Control Technology (BADCT).

A combination of limestone followed by lime treatment in the first stage, followed by settling between each stage for solids removal, followed by slaked lime treatment in the second stage, followed by settling, is planned for Swift Creek.

Process water will be first reacted with ground limestone to a pH of 3.0 and settled in a settler. The clear overflow will then be reacted with slaked lime to a pH of 5.5 and settled in a small pond. Clear liquor from the lime-treatment settling pond in the first stage will be further reacted with slaked lime in Stage II to a pH of 9.0 and settled in a pond. The clear overflow discharged to surface waters is expected to have a pH of 9.0, fluoride content of 1220 MG/L, and phosphate content of 1-13 MG/L as phosphorus, and other impurities as shown in Table 1.4-5.

Use of ponds or lagoons for settling and sludge storage precludes combination of sludges from both lime treatment stages, due to the treatment requirement for separate, intermediate clarification. Sludge from the first lime treatment stage will be combined with the calcium carbonate sludge for disposal with gypsum.

1.4.2.1.8 Nonprocess Water Contamination Control & Treatment Facilities

Nonprocess water discharge at 1.65 MGD (1,142 GPM), plus rainfall run-off, will normally be suitable for direct discharge. In the event of contamination, the discharge will be diverted to the second stage of the neutralization station as discussed below.

Nonprocess water may become contaminated with process water, phosphoric acid, sulfuric acid, or rainfall run-off. Experience in the phosphate industry has shown that when contamination does occur, the levels of fluorides, phosphate, and/or sulfuric acid are generally much lower than for process water. Neutralization of contaminated nonprocess water in the process water neutralization system has been practiced successfully for many years by most Florida phosphate companies and the required effluent limitations can be achieved.

Table 1.4-4 Expected Process Water Analysis--Swift Creek Chemical Complex Based on Suwannee River Chemical Complex Sampling

Analysis(1)	8/20/77	12/8/77
pH, Std. Units	1.65	1.70
Total Acidity, as $CaCO_3$	34,385	32,800
Mineral Acidity, as $CaCO_3$	20,976	-
Fluoride, as F	6,500	6,600
Total Phosphorus, as P	4,290	3,960
Total Suspended Solids	35	69
Total Dissolved Solids	26,250	25,952
Sulfate, as SO_4	5,700	6,200
Chloride, as Cl	45	72
Conductivity, as umhos	24,000	-
Sodium, as Na	1,094	896
Silica, as Si	1,406	1,294
Aluminum, as Al	389	409
Iron, as Fe	263	204
Magnesium, as Mg	44	76
Lead, as Pb	-	<0.1
Manganese, as Mn	-	7.88
Calcium, as Ca	500	77

(1) All values expressed as mg/l unless otherwise noted.

Table 1.4-5 Expected Effluent Quality Produced by Two-stage Limestone-Lime Treatment

Analysis(1)	Process Water	Stage II Supernatant
pH, Std. Units	1.70	9.0
Acidity, as $CaCO_3$	32,800	-
Fluoride, as F	6,600	12-20
Total P	4,000	1-13
Total Suspended Solids	69	15
Chlorides, as Cl	72	75
Sulfates, as SO_4	6,200	2,709
Sodium as Na	896	900
Calcium, as Ca	77	375
Magnesium, as Mg	44	22
Aluminum, as Al	389	<0.2
Chrome, as Cr	0.43	<0.10
Zinc	1.46	<0.10
Iron, as Fe	263	0.10
Manganese, as Mn	7.9	0.03
Boron, as B	0.90	<0.50
Lead, as Pb	<0.10	<0.10

(1) All values in mg/l unless otherwise noted.

Nonprocess water will discharge to a freshwater ditch in the chemical plant, which discharges to a nonprocess surge pond, which discharges to a second freshwater ditch, which discharges to the Section 10 pond, which discharges to Swift Creek. Prevention and control of contamination of nonprocess water will be accomplished in several ways.

First, all acid process and storage areas will be curbed, and separated from nonprocess waters and rain run-off areas. Acid leaks and spills will be collected and returned to the process or to the process water (pond water) system.

Second, any point source nonprocess water that could become contaminated by leaks will be pH monitored in each process area on a routine basis and diverted, if required, from the first freshwater ditch to the process water (pond water) system until the leaks are repaired and the pH has returned to normal (>pH 5.5).

Third, nonprocess water that cannot become contaminated and rain run-off from nonprocess areas will go directly by way of the first freshwater ditch to the nonprocess water surge pond. This pond will be 30 acres in size, 20 feet deep, and have a retention time of over 100 days except during rainfall periods. Inlet and outlet of the pond will be continuously pH recorded and alarmed for low pH levels (instruments will be located in a process control room) so that prompt and proper corrective action can be taken. The long retention time will dampen any contamination caused by leaks or spills. These alarm systems are set for a pH 5.5 level.

Fourth, if the pH leaving the nonprocess surge pond to the second freshwater ditch becomes too low, the discharge will be diverted to the Stage II neutralization station, treated with lime, and settled in a pond. Effluent limitation requirements are identical to process water.

Fifth, overflow from the Stage II settling pond will be discharged back to the second freshwater ditch going to the Section 10 pond for final clarification before discharging to Swift Creek. The Section 10 pond is 150 acres and 20 feet deep and has a retention time of 156 days, except during rainfall periods (based on nonprocess water discharge rate and Swift Creek Mine water discharge rate). This long retention time will allow clarification of the nonprocess and mine discharge water for removal of suspended solids and will dampen out any pH or contaminant changes should all of the first four control actions malfunction simultaneously-which is highly unlikely.

1.4.2.1.9 Description of Environmental Aspects of Support Facilities - SCCC

Gypsum Stack and Cooling Pond System: A new gypsum stack and cooling pond will be provided to store by-product waste gypsum from the phosphoric acid plant and to provide atmospheric cooling for process water (pond water) recirculated to the process units. The gypsum stack, cooling pond and surge pond areas will total 550 to 600 acres for rainfall collection and have a total wet area of 230 to 250 acres for cooling and solar evaporation. Process heat removal by atmospheric cooling will also result in evaporation of water from the cooling pond.

Cool pond water from the cooling pond will be recirculated to the process units at a rate of 64 MGD to 84 MGD (44,000 to 58,000 GPM) depending on demand, for process use or condensation of steam in the phosphoric acid plant, 28-54 percent P_2O_5 evaporators, clarification, the superphosphoric acid plants, and SPA storage and shipping. The warm pond water will be recirculated to the cooling pond for cooling. A portion of the warm water will be used to slurry the by-product gypsum cake from the phosphoric acid plant filter and the slurry will be pumped to the gypsum stack. The gypsum will settle in the stack and the separated pond water will overflow to the cooling pond.

The gypsum stack-cooling pond system has a deficit water balance of 158 GPM and will not discharge to the treatment system except following periods of exceptionally heavy rainfall. Design of the system provides a water surge volume of 1.5 times the surge required for a 25-year 24-hour rainfall event. In case of discharge, the water will be sent to the treatment system described in Section 1.4.2.1.7 (Treatment Facilities).

Fresh Water Supply: A new deep well with a capacity of 7,000 GPM will supply all fresh water requirements for the proposed chemical plant. This well will be operated in parallel with the two existing 7,000 GPM wells at the Swift Creek Mine so that two wells will be operating with one well as a spare for most of the year. Casing depth of the new well will be about 800 feet and it is expected that the water analysis will be very similar to the existing Swift Creek Mine wells.

Process Chemicals and Supplies: Process chemicals required for boiler feed water and cooling tower water treatment, as shown in Table 1.4-6, are based on Sulfuric Acid Plants C&D at the existing SRCC. The expected concentration increase of the nonprocess water in the freshwater ditch resulting from the use of these chemicals is also shown in Table 1.4-6.

Defoamer use will be budgeted at 700 metric tons per year and is used in Phosphoric Acid Plant D, 27-54 percent Evaporation, Clarification, and the SPA Plants for foam control. A water soluble defoamer is used and ends up in the SPA acid and the process water circuit. No discharge occurs to the nonprocess water system.

Table 1.4-6 Process Chemicals-Sulfuric Acid Plant Boiler and Cooling Tower Chemicals (at Rated Capacities)

Water Treatment Chemicals(1)

Unit	Material	Sulfuric Acid Plants E & F	Description
Boiler	Liqui-Treat	187	Organic & Inorganic Chelates
"	NA-5	12	Neutralizing Amine
"	Corrogen	36	Catalyzed Sodium Sulfite
Cooling	Betz 430 or 431	112	L.W. Polymer and Phosphonate Dispersant
"	Slimicide J-12	42	Non-Oxidizing Biocide
"	Chlorine	21	Chlorine

EFFLUENT LOADINGS(1)

Chemical	Sulfuric Acid Plants E & F lbs/day	Concentration Increase in Non-Process Water(2)	
Sulfate & Sulfide as SO_4	2,467	179	MG/L
Chloride as Cl	139	10.1	MG/L
Calcium as $CaCO_3$	1,646	120	MG/L
Magnesium as $CaCO_3$	623	453	MG/L
Silica as SiO_2	275	20	MG/L
Total Phosphate as PO_4	43	3.1	MG/L
Total Copper as Cu	0.15	10.9	μGM/L
Total Iron as Fe	3.7	0.28	MG/L
Soluble Zinc as Zn	0.25	18.2	μGM/L

(1) Betz Laboratories, Inc. to Occidental Chemical, 12/23/77 for SRCC, adjusted for SCC plants capacity

(2) Based on Fresh Water Ditch Flow of 1.65 MGD--excludes rainfall run-off

Inorganic chemicals, budgeted at 13,000 metric tons per year, will leave the plant site as a by-product. No discharge occurs to the nonprocess water system.

Limestone will be budgeted at 6,268 metric tons per year and will leave the plant site as a by-product and used to treat nonprocess water when it becomes contaminated. Lime will be budgeted at 643 metric tons per year and will also be used to treat nonprocess water.

Electric Power: 11.2 MW electric power will be generated onsite using high pressure steam from Sulfuric Acid Plants E & F and the balance will be supplied by Florida Power Corporation.

Fuel Oil: A low sulfur commercial distillate fuel oil fired in auxiliary boilers to supply high pressure steam will be stored in tanks surrounded by an embankment to contain leaks or spills.

Domestic Wastewater Treatment Facilities: The proposed waste treatment plant will service the office, laboratory, shops, Phosphoric Acid Plant D, Sulfuric Acid Plants E & F, 28-54 percent P_2O_5 Evaporation, Purification Plant, Superphosphoric Acid Plants C & D, and SPA storage and shipping. A 25,000 gallon per day design to serve a population of 180 persons is proposed. Treatment will consist of an extended aeration process followed by chlorination with effluent to mines water recirculation system. The allowable effluent limitation in Florida is 90 percent treatment or better.

LIST OF REFERENCES
(Section 1.4)

Aerial photographs of Suwannee River Chemical Complex plant site. Scale of photographs is 1" = 333'.

Ardaman and Associates, Inc. Rainfall and solar evaporation areas for Gypsum Stack and Cooling Pond (telephone conversation).

Florida, State of, Department of Environmental Regulation (FDER), Construction Permits.

Occidental Chemical Company, Aerial photograph of Suwannee River Chemical Complex area including ponds and NPDES Discharge Point 001--scale, 1" = 1000'. Nonprocess water, process water, and rainfall routes outlined by Occidental Chemical Company's Environmental personnel.

Occidental Chemical Company, Information from various Occidental Chemical Company environmental, operating, management, and SPA project personnel (meetings, written communications, telephone calls).

OXY/SPA Project Scope Addendum.

SECTION 2.0

ENVIRONMENT WITHOUT THE PROPOSED ACTION

2.1 METEOROLOGY AND CLIMATOLOGY

2.1.1 CLIMATOLOGY

The Occidental site is characterized by dry winters and rainy summers, a high percentage of sunshine, and high humidity. The site seldom experiences strong winds or severe cold weather.

2.1.2 PRECIPITATION AND EVAPORATION

The rainfall in North Florida can be divided into two regions; the wet summer months (June-September) and the dry fall and winter months. The rainfall during the summer months is characterized by intense, localized thunderstorms which account for approximately half the annual precipitation. During this period, the monthly rainfall averages 5 to 8 inches and precipitation can be expected one day in two.

During the remaining period (October-May), precipitation is associated with the passage of frontal systems and is usually widespread and of low intensity. Monthly rainfall during this period averages 2 to 4 inches.

Severe rainfall can occur any time throughout the year but is usually associated with thunderstorm activity or the passage of tropical disturbances. The mean annual rainfall for the area averages 54 inches with variations from 33 inches to 75 inches.

The average annual open water evaporation in Hamilton County is approximately 46 inches per year (Visher and Hughes, 1969) and the evapotranspiration rate from soil and vegetation averages 40 inches per year (Fisk, 1977).

2.1.3 ATMOSPHERIC VENTILATION

Atmospheric ventilation includes wind speed, wind direction, mixing depth and atmospheric stability. Valdosta, Georgia surface observations and Waycross, Georgia upper air data for the period 1972-1976 were used as a source of these data. Wind speed at the site is quite moderate. The annual average speed is 3.1 meters per second (7 mph); that exceeded 10% of the time is 5 meters per second (11 mph).

Wind direction shows a slight northeast-southwest predominance annually. Seasonably the wind direction distributions are more skewed (Figure 2.1-1).

The stability of the atmosphere, defined by insolation and wind speed, is classified unstable 25% of the time, natural 33% and stable 42%.

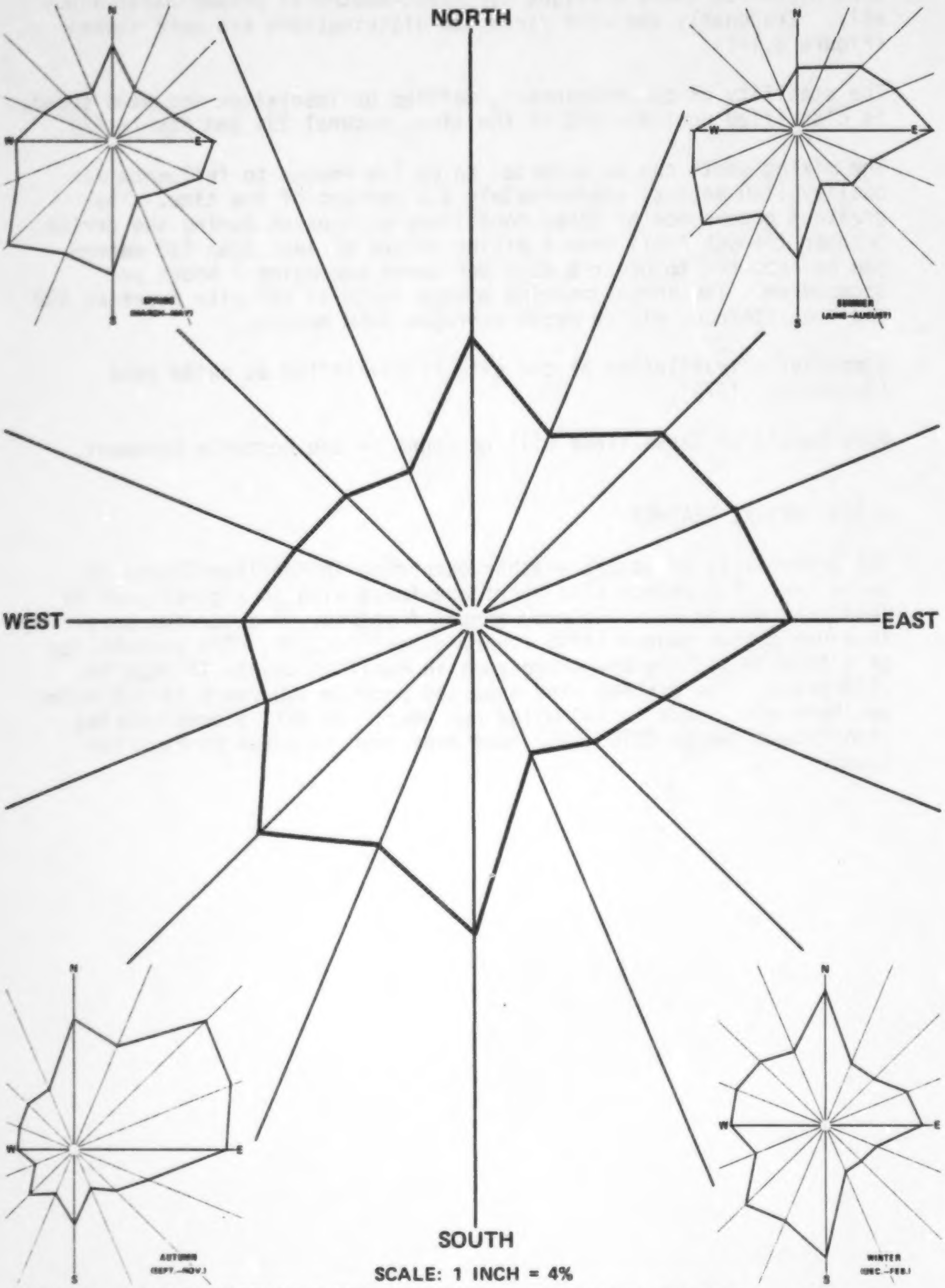
The mixing depth can be expected to be low enough to influence air quality (120 meters) approximately 4.5 percent of the time. The greatest occurrence of these conditions will exist during the period October through April when a mixing height of less than 120 meters can be expected to occur 6 days per month averaging 7 hours per occurrence. The annual morning mixing depth at the site averages 500 and the afternoon mixing depth averages 1450 meters.

Atmospheric ventilation at the site is classified as quite good (Holzworth, 1972).

More detail on these items will be found in the Resource Document.

2.1.4 SEVERE WEATHER

The probability of severe weather occurring in Hamilton County is quite low. The chance of a hurricane-force wind in a given year is less than one in 50. The mean annual frequency of a tornado occurring in a one degree square (4145 square miles) is 0.65. The probability of a tornado hitting any given spot in Hamilton County is once in 2260 years. The extreme wind expected once in 100 years is 110 miles per hour with gusts to 143 miles per hour. No hail storms causing significant damage ($100,000) have ever been reported in Hamilton County.



SCALE: 1 INCH = 4%

ANNUAL WIND DIRECTION DISTRIBUTION VALDOSTA,GEORGIA 1972-1976

SOURCE: NATIONAL WEATHER SERVICE SCALE FOR INSETS: 1/2 INCH = 5%

FIGURE 2.1-1

LIST OF REFERENCES
(Section 2.1)

Fisk, D.W. (1977), "Water Balance, Suwannee River Water Management District"; Information Circular No. 3. September 1977.

Holzworth, G.C. (1972), "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States"; U.S. Environmental Protection Agency, AP-101. January 1972.

Visher, F.N. and G.H. Hughes (1969), "The Difference Between Rainfall and Potential Evaporation in Florida"; Florida Department of Natural Resources, United States Geological Survey, Map Series No. 32. August 1969.

2.2 AIR QUALITY

Preconstruction air quality was established for the 1977-78 period. The pollutants considered in defining air quality are fluorides and the EPA designated "criteria pollutants" sulfur dioxide, (SO_2), total suspended particulate matter (TSP), carbon monoxide (CO), nitrogen oxides (NO_x) and hydrocarbons.

The procedure used for establishing ambient levels of SO_2 and TSP was air quality modeling with measured levels of these pollutants being used to establish background concentrations. The procedure for establishing the preconstruction impact of fluoride emissions involved a combination of ambient measurements and the observation of sensitive receptors. Only emission inventories were prepared for CO, NO_x and hydrocarbons since these contaminants are emitted in small amounts throughout the study area.

2.2.1 METHODOLOGY

The development of an emission inventory for SO_2 and particulate matter and the subsequent evaluation of the impact of these emissions by air quality modeling was quite straightforward. The emission rates of both were readily measurable or could be estimated with confidence and air quality models are applicable for estimating the dispersion and transport of these materials.

The evaluation of fluoride emissions presented some difficulties, however. Because of the uncertainty in establishing an emission rate of fluorides from gypsum and cooling ponds (estimated range from 0.1 to 10 pounds per acre day) and the fact that fluoride emissions from the pond surfaces cannot readily be simulated with air quality models, an alternative approach was used for establishing existing fluoride impact.

The impact of existing fluoride emissions was defined in terms of:

1. Measured ambient air fluoride concentrations.
2. Measured fluoride concentrations in grass.
3. Observed effects of fluorides on cattle.
4. Observed effects of fluoride on vegetation.

The emission burden of CO, NO_x and hydrocarbons were estimated for Hamilton County using emission factors developed by EPA (1976).

Air quality modeling to establish preconstruction levels of SO_2 and TSP was conducted in accordance with guidelines published by the U.S. Environmental Protection Agency (EPA 1977). The Air Quality Display Model (AQDM) was used for simulating annual conditions and the PTMTPW was used for simulating short-term conditions.

Both models incorporated the Briggs plume rise equation and were used with a calibration factor of 1.0.

A five-year record of meteorological data from Valdosta and Waycross, Georgia, was used with these models (see Section 2.1).

For all Occidental sources, the only sources significantly impacting on the study area, an annual average emission rate and a short-term maximum emission rate for SO_2 and particulate matter was determined. The maximum emission rates were determined by emission measurements or were calculated from known process variables. The annual average emission rates were calculated from the maximum emission rates taking into account annual average production rates and the fraction of time each source operated during an annual period. The annual average and short-term emission data for the Occidental sources for the 1977-78 period are available in the Resource Document.

2.2.2 EXISTING AIR QUALITY

Preconstruction air quality for the 1977-78 time period was determined for SO_2 and TSP by air quality modeling and ambient air quality monitoring. Ambient fluoride levels in the ambient air and in grass were monitored during the 1977-78 period. Surveys were made in 1977 and 1978 to determine the effects of fluorides on vegetation and in 1978 to determine the effect of fluorides on cattle.

2.2.2.1 Existing Sulfur Dioxide Levels

Ambient levels of SO_2 in the study area were determined by air quality modeling techniques. In addition, ambient sulfur dioxide levels have been measured at four sites with continuous monitoring instrumentation since May, 1977 using Meloy Model SA-285 equipment.

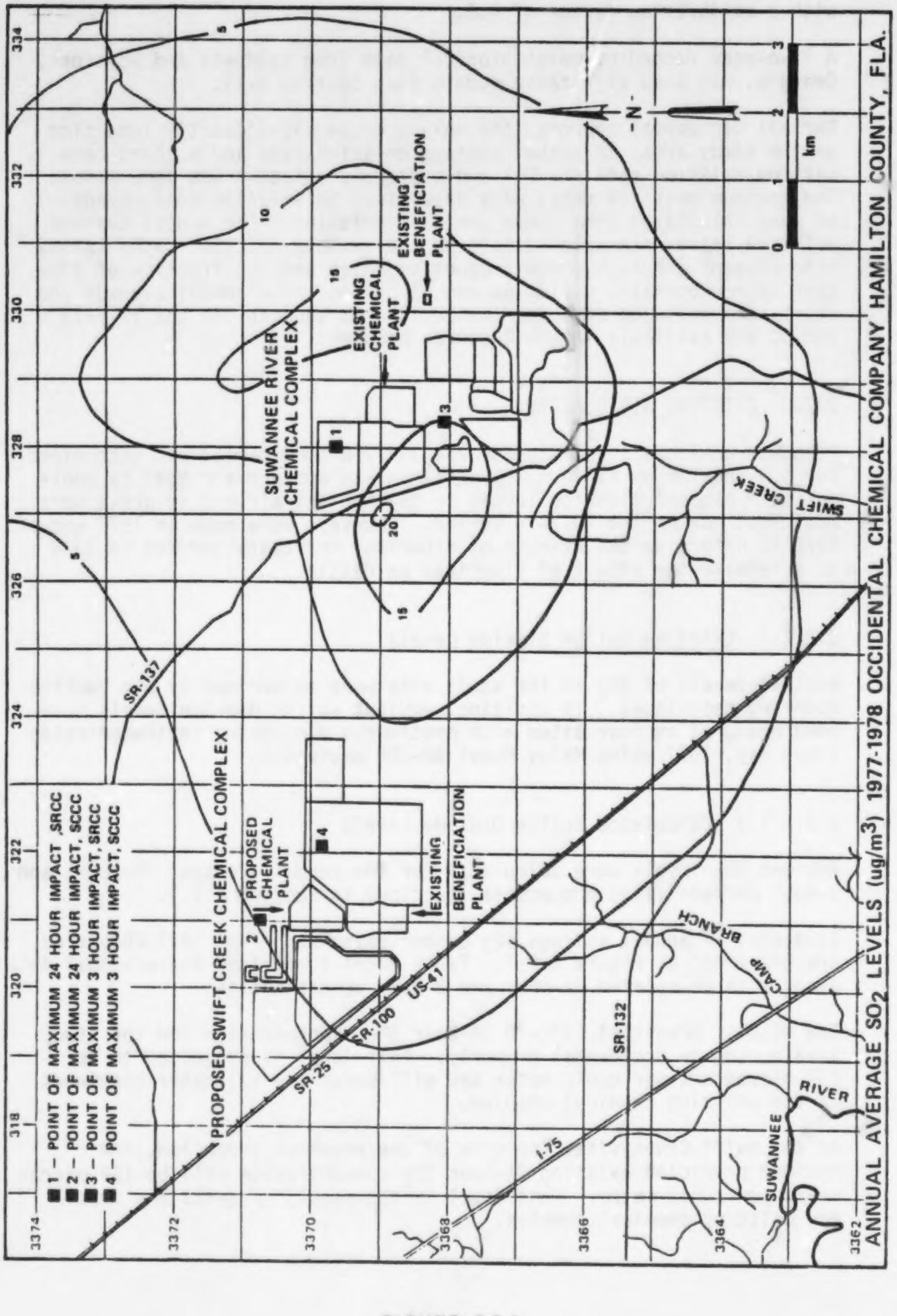
2.2.2.1.1 Calculated Sulfur Dioxide Levels

Ambient SO_2 levels were calculated for the annual average, 24-hour, and 3-hour periods using procedures described in Section 2.2.1.

Isopleths of annual average SO_2 concentrations for the 1977-78 period are presented as Figure 2.2-1. Table 2.2-1 summarized these annual data along with calculated 24-hour and 3-hour concentrations.

The highest predicted 1977-78 24-hour SO_2 concentration for the study area occurs on Occidental property. This level is projected to be 254 micrograms per cubic meter and will occur one kilometer northwest of the existing chemical complex.

At the Swift Creek site, the site of the proposed expansion, the maximum predicted existing 24-hour SO_2 concentration will be 105 micrograms per cubic meter. This level is the result of emissions from the existing chemical complex.


ANNUAL AVERAGE SO$_2$ LEVELS (ug/m^3) 1977-1978 OCCIDENTAL CHEMICAL COMPANY HAMILTON COUNTY, FLA.
■ 1 — POINT OF MAXIMUM 24 HOUR IMPACT, SRCC
■ 2 — POINT OF MAXIMUM 24 HOUR IMPACT, SCCC
■ 3 — POINT OF MAXIMUM 3 HOUR IMPACT, SRCC
■ 4 — POINT OF MAXIMUM 3 HOUR IMPACT, SCCC
PROPOSED SWIFT CREEK CHEMICAL COMPLEX
PROPOSED CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
SUWANNEE RIVER CHEMICAL COMPLEX
EXISTING CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
SR-137
SR-25
SR-100
US-41
SR-132
I-75
SWIFT CREEK
CAMP BRANCH
SUWANNEE RIVER
5
10
15
20
15
5
N
0 1 2 3
km
318
320
322
324
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332
334
3374
3372
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3362

FIGURE 2.2-1

Table 2.2-1 Summary of Air Quality Modeling for 1977-78 SO_2 Levels, Occidental Chemical Company

		Maximum Calculated SO_2 Concentration ($\mu g/m^3$)	
Averaging Time	FDER Air Quality Standard	Occidental SCCC(1)	Occidental SRCC(1)
Annual	60	7	20
24-Hour	260	105	254
3-Hour	1,300	35	1214

(1) SCCC = Swift Creek Chemical Complex and SRCC = Suwannee River Chemical Complex.

The highest calculated 3-hour SO_2 level for the 1977-78 period was calculated to be 1214 micrograms per cubic meter. This concentration is expected to occur south of the existing Chemical complex. The maximum 3-hour SO_2 concentration predicted for the Swift Creek site is 35 micrograms per cubic meter, and will result from emissions from the existing chemical complex.

All calculated SO_2 levels are below applicable state and federal air quality standards.

2.2.2.1.2 Measured Sulfur Dioxide Levels

Ambient air monitoring for SO_2 has been conducted by Occidental since 1973. Since May, 1977, SO_2 levels have been monitored with four continuous sulfur dioxide monitors. The location of these monitors is shown in Figure 2.2-2.

The data show that the long-term arithmetic mean SO_2 level is quite low; in the range of 1 to 10 micrograms per cubic meter during normal plant operation. The highest measured 24-hour SO_2 level under periods of normal plant operation was 197 micrograms per cubic meter. The highest second-high measured 24-hour SO_2 level was 85 micrograms per cubic meter (Table 2.2-2). These levels are all below applicable air quality standards.

2.2.2.2 Existing Total Suspended Particulate Matter Levels

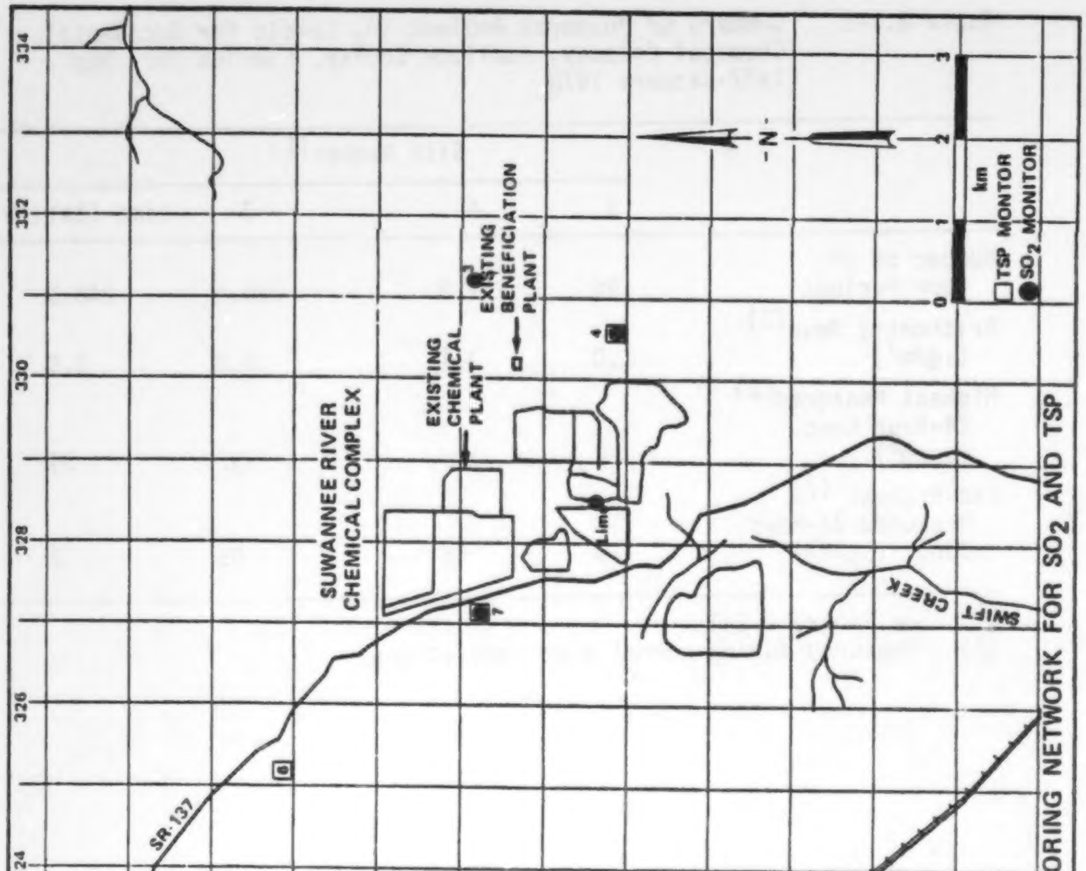
Total suspended particulate matter (TSP) levels in the study area were determined by air quality modeling techniques for the 1977-78 period. In addition to the air quality modeling, TSP levels have been monitored in the area since October, 1975.

2.2.2.2.1 Calculated Total Suspended Particulate Matter Levels

Ambient TSP levels were established for 1977-78 using air quality modeling techniques. For both periods of time, the annual average and 24-hour TSP levels were calculated. The modeling techniques used are described in Section 2.2.1.

Annual average TSP levels for the 1977-78 period are presented as Figure 2.2-3. These data are also summarized in Table 2.2-3. The maximum concentrations predicted for the study area was only 3 micrograms per cubic meter above the background level of 31 micrograms per cubic meter (Figure 2.2-3).

The highest calculated 24-hour TSP level occurs just west of the existing chemical complex on Occidental property. During the 1977-78 period, this level was projected to be 116 micrograms per cubic meter including 61 micrograms per cubic meter of background particulate matter.


AIR QUALITY MONITORING NETWORK FOR SO_2 AND TSP
PROPOSED SWIFT CREEK CHEMICAL COMPLEX
PROPOSED CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
SUWANNEE RIVER CHEMICAL COMPLEX
EXISTING CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
Lime
SR-137
SR-25
SR-100
US-41
SR-132
I-75
SWIFT CREEK
CAMP BRANCH
SUWANNEE RIVER
N
km
0
1
2
3
TSP MONITOR
SO_2 MONITOR
1
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6
7
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320
322
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326
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332
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FIGURE 2.2-2

Table 2.2-2 Summary of Measured Ambient SO_2 Levels for Occidental Chemical Company, Hamilton County, Florida for May 1977-January 1978

	Site Number(1)			
	3	4	7	Lime Station
Number of 24-Hour Periods	196	252.5	210.5	248.5
Arithmetic Mean(2) ($\mu g/m^3$)	1.0	3.1	9.8	2.0
Highest Measured(2) 24-Hour Conc. ($\mu g/m^3$)	35	149	197	34
2nd Highest (2) Measured 24-Hour Conc. ($\mu g/m^3$)	16	56	85	32

(1) See Figure 2.2-4
(2) Measured during normal plant operations.

Table 2.2-3 Summary of Air Quality Modeling for 1977-78 of Total Suspended Particulate Matter Levels for Occidental Chemical Company

Averaging Time	FDER Air Quality Standard	Maximum Calculated TSP Concentration ($\mu g/m^3$)	
		Occidental SCCC(1)	Occidental SRCC(1)
Annual(2)	60	33	34
24-Hour(3)	150	77	116

(1) SCCC = Swift Creek Chemical Complex and SRCC = Suwannee River Chemical Complex.
(2) Includes background of 31 micrograms per cubic meter.
(3) Includes background of 60 micrograms per cubic meter.

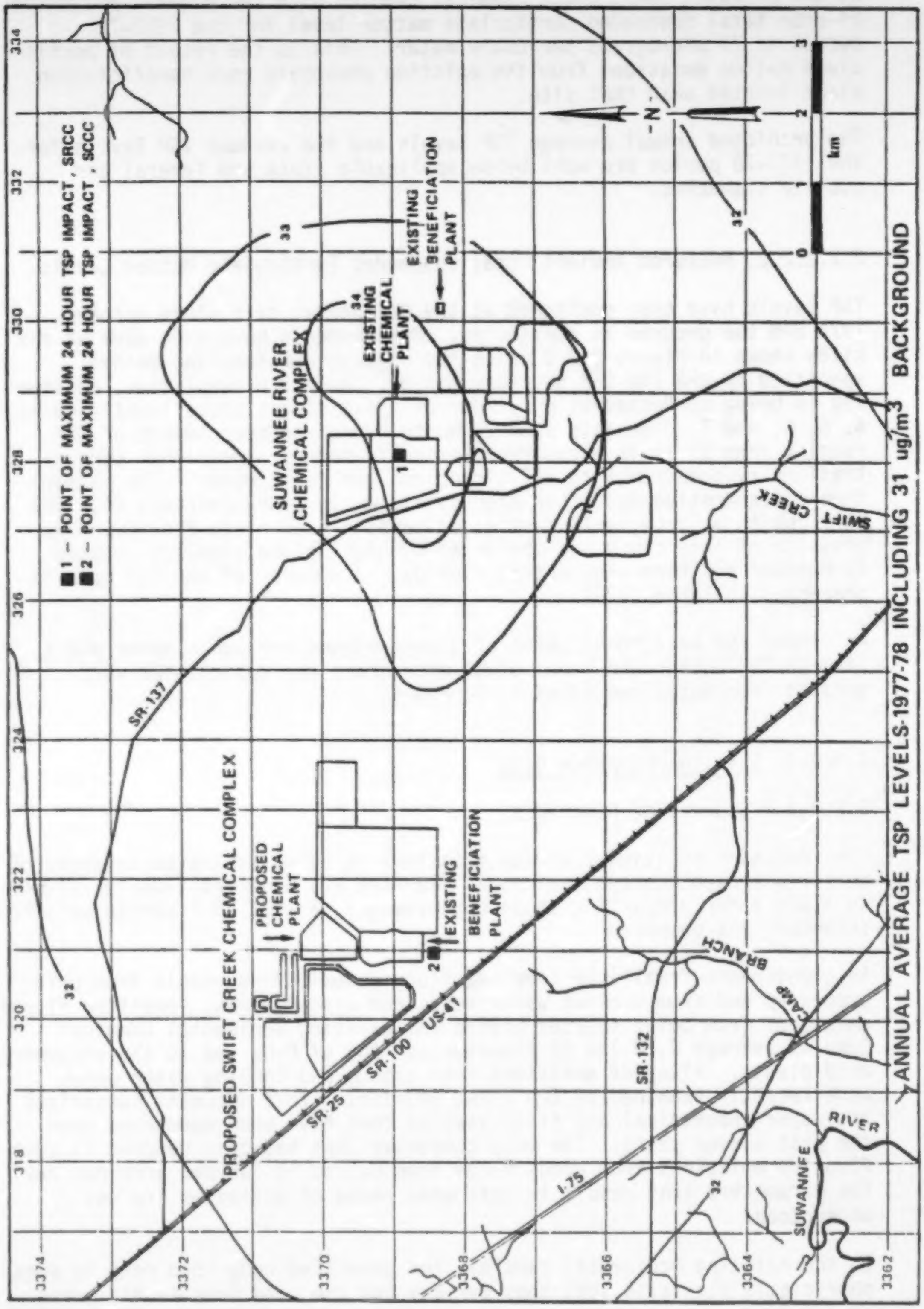
ANNUAL AVERAGE TSP LEVELS-1977-78 INCLUDING 31 ug/m3 BACKGROUND
■1 – POINT OF MAXIMUM 24 HOUR TSP IMPACT, SRCC
■2 – POINT OF MAXIMUM 24 HOUR TSP IMPACT, SCCC
N
km
0
1
2
3
SUWANNEE RIVER CHEMICAL COMPLEX
EXISTING CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
PROPOSED SWIFT CREEK CHEMICAL COMPLEX
PROPOSED CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
SR-137
SR-25
SR-100
US-41
SR-132
I-75
SWIFT CREEK
CAMP BRANCH
SUWANNEE RIVER
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FIGURE 2.2-3

At the proposed Swift Creek chemical complex site the highest projected 24-hour total suspended particulate matter level for the 1977-78 period is 77 micrograms per cubic meter. This is the result of particulate matter emissions from the existing phosphate rock beneficiation plant located near that site.

The predicted annual average TSP levels and the 24-hour TSP levels for the 1977-78 period are well below applicable state and federal air quality standards.

2.2.2.2.2 Measured Ambient Total Suspended Particulate Matter Levels

TSP levels have been monitored at the Occidental site since October, 1975 and the program is continuing. Measurements have been made at six sites shown in Figure 2.2-2 using the high-volume sampling method specified by EPA (40 CFR 50, Appendix B). At the present time, monitoring is being conducted at only four of these sites; those identified as 4, 5, 6, and 7. The data show 24-month geometric mean levels of TSP ranging from 25 to 45 micrograms per cubic meter. Individual concentrations ranged from 5 to 757 micrograms per cubic meter. The extreme high concentration and other high levels measured on February 24, 1977 were due to a large scale dust cloud passing over north Florida. The presence of this cloud was confirmed by high volume samplers located throughout northern and central Florida. A summary of the TSP data is presented in Table 2.2-4.

An annual TSP background level of 31 micrograms per cubic meter and a 24-hour TSP background level of 61 micrograms per cubic meter were derived from data from sites 1, 2, and 5.

2.2.2.3 Existing Fluoride Data

2.2.2.3.1 Sources of Fluorides

The impact of existing fluoride emissions is being evaluated in terms of measured ambient concentrations of fluoride and observed fluoride effects. As a basis for projecting these observations, a 1977-78 fluoride emissions inventory was prepared.

In a phosphate fertilizer complex, fluoride emissions result from unit processes and from cooling water ponds and gypsum ponds. Permitted fluoride emissions from point sources within the existing Occidental Chemical Complex average 0.20 lbs of fluoride per ton of P_2O_5 fed to the phosphoric acid plants. Fluoride emissions from gypsum and cooling water ponds were recently examined by EPA (EPA, undated). This document summarizes the major theoretical and field studies that have been conducted over the past eleven years. The only consensus that has been reached is that fluoride emissions from ponds range from 0.1 to 10 lbs per acre per day. The parameters that result in this wide range of estimates are not understood.

In the existing Occidental complex, the permitted P_2O_5 feed rate to phosphoric acid plants is 1895 tons per day and the pond area is 412 acres.

Table 2.2-4 Summary of Total Suspended Particulate Matter Monitoring Data for Occidental Chemical Company, Hamilton County, Florida for October 1975-October 1977

	Site Number[a]					
	1[b]	2[c]	4	5	6	7
Number of Samples	47	100	91	97	28	93
Geometric Mean Conc. (μg/m^3)	25	31	43	38	41	37
Expected Second Max. Conc. (μg/m^3)	69	81	148	96	(c)	140
95th Percentile Conc. (μg/m^3)	48	58	100	82	(c)	73

[a] See Figure 2.2-2.

[b] Sites discontinued in May 1977.

[c] Sample size too small.

The permitted process fluoride emission rate will therefore be 379 lbs per day and pond emissions will be proportional to the pond area.

2.2.2.3.2 Fluoride in the Environment

Since there is no agreement in the scientific community on the fluoride emission rate from ponds (EPA, undated), and since emissions from ponds cannot be reasonably simulated with air quality models, the impact of existing fluoride emissions was determined by:

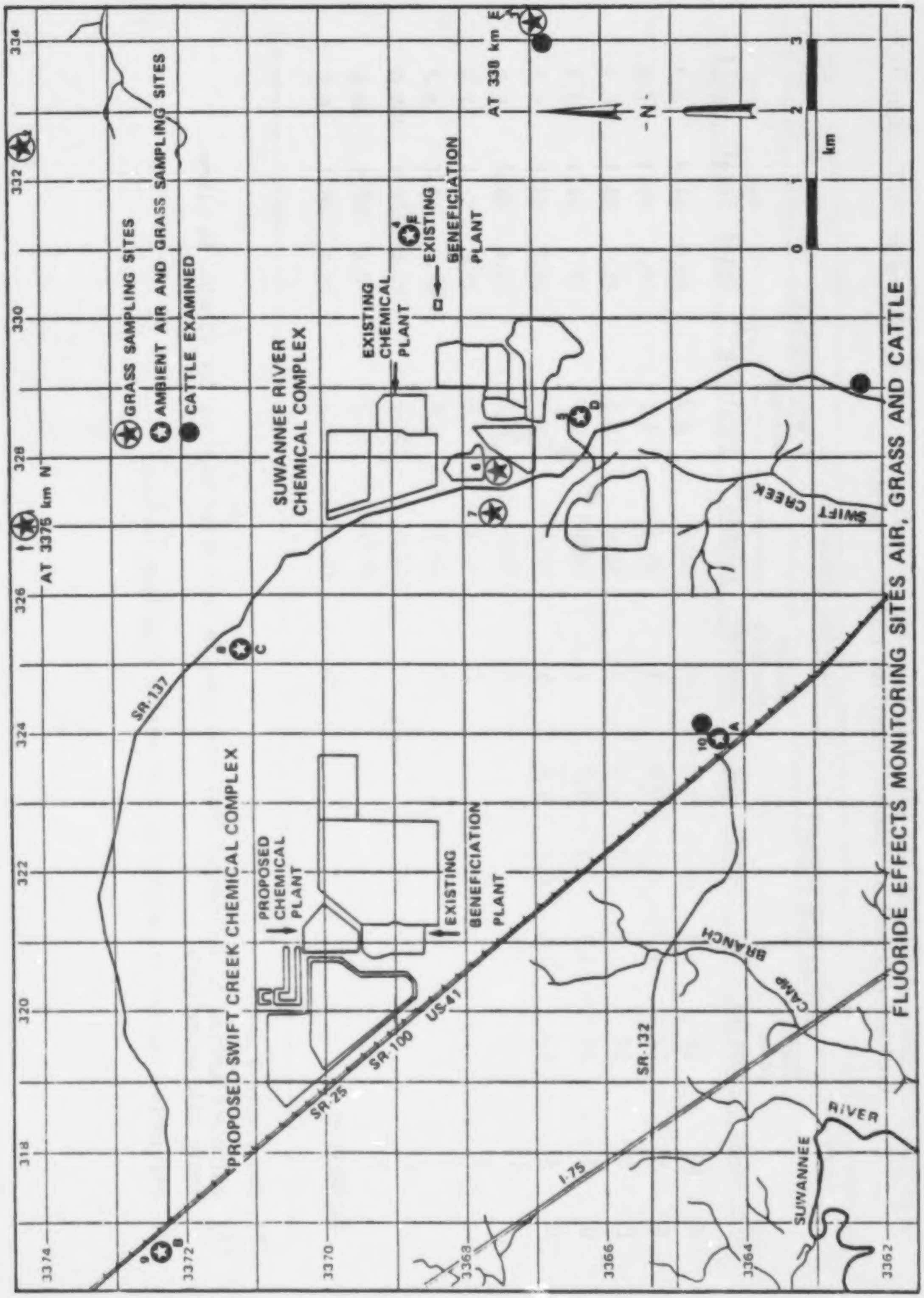
1. Measuring gaseous fluoride concentrations in the ambient air.
2. Measuring the fluoride concentrations in grass.
3. Observing the effects of fluorides on cattle.
4. Observing the effects of fluorides on vegetation.

Airborne Fluorides: Gaseous fluorides in the ambient air have been measured at five monitoring sites (Figure 2.2-4) since November 1977. The monitoring data through April 14, 1978, are summarized in Table 2.2-5. It will be noted that there is very little spatial variation in ambient fluoride levels. The average concentrations range from 0.7 to 1.0 micrograms per cubic meter. The average concentration for all sites is 0.8 micrograms per cubic meter. 24-hour concentrations range from 5.1 micrograms per cubic meter to 0.1 micrograms per cubic meter.

Fluoride in Grass: One of the potential economic impacts of fluoride in the environment is the damage caused to livestock by ingestion of forage materials containing fluorides. In significant concentrations, the fluorides create a condition known as fluorosis. This manifests itself in mottling and/or softening of the teeth of livestock, and in more severe cases, in alterations of bone structure.

The threshold concentration in forage material at which these effects become noticeable in beef and dairy heifers is 40 ppm of a soluble fluoride and 60 ppm of an insoluble fluoride. (National Academy of Sciences, 1974). For other species, higher dietary fluoride levels can be tolerated.

To determine the level of fluorides in potential forage materials near the Occidental site, ten sampling locations were selected. Eight of these represented potential pasture land, one site was on the dike of a cooling water pond and one site was located an intermediate distance from the cooling water pond. These sampling sites are shown in Figure 2.2-4. In addition to these sites, a background site was selected in Gainesville, Florida.


GRASS SAMPLING SITES
AMBIENT AIR AND GRASS SAMPLING SITES
CATTLE EXAMINED
PROPOSED SWIFT CREEK CHEMICAL COMPLEX
PROPOSED CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
SUWANNEE RIVER CHEMICAL COMPLEX
EXISTING CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
AT 3375 km N
AT 338 km E
SR-137
SR-25
SR-100
US-41
SR-132
I-75
SWIFT CREEK
CAMP BRANCH
SUWANNEE RIVER
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FLUORIDE EFFECTS MONITORING SITES AIR, GRASS AND CATTLE

FIGURE 2.2-4

Table 2.2-5 Summary of Ambient Air and Grass Fluoride Concentration Data for November 1977 - June 1978, Occidental Chemical Company, Hamilton County, Florida

Site(1)		Fluoride Concentration									
		Ambient Air (μg/m³)				Grass (mg/kg)					
							Average				
Air	Grass	Number 24-hr Samples	Max.	Min.	Avg.	Number Monthly Samples	Soluble(2)	Insoluble(3)	Total	Max. Total	Min. Total
A	10	24	5.1	0.1	1.0	7	34.3	8.7	43.0	81.9	8.3
B	9	24	4.3	0.1	0.8	7	33.4	6.2	39.6	69.3	7.6
C	8	24	3.1	0.2	0.8	7	35.9	10.5	46.4	88.1	10.9
D	5	21	3.1	0.1	0.7	7	28.4	8.7	37.1	52.9	13.4
E	4	22	2.5	0.3	0.9	5	17.6	9.3	26.9	50.1	6.1
	1					7	20.6	4.4	25.0	55.8	5.2
	2					7	32.3	7.5	39.8	81.4	11.6
	3					7	32.1	5.8	37.9	72.2	9.7
	6					7	229.0	94.0	323.0	474.0	205.0
	7					7	47.3	23.3	70.6	137.4	30.6
Background						5	16.3	2.3	18.6	36.1	6.7

(1) See Figure 2.2-4

(2) Soluble Fluoride is defined as that remaining in leaf after washing for 15 min. in ultrasonic cold water bath.

(3) Insoluble Fluoride is defined as that washed from leaf surface.

The fluoride levels in the grass samples collected during the period December through March are presented in Table 2.2-5. It should be noted that this is the period of the year when fluoride levels in vegetation are traditionally the highest from the point of view that this is the season of least rainfall (EPA, 1978).

Monthly fluoride concentrations ranged from 5 to 87 ppm total fluoride in grass away from the existing chemical plant. The fraction of fluorides contained in the grass (soluble) averaged 69 percent. The fraction contained on the surface of the leaf (insoluble) averaged 31 percent.

The grass from the monitoring site located on the dike of the cooling water pond exhibited an average fluoride concentration of 300 ppm with approximately 57 percent of the fluoride being contained in the leaf of the grass. Grass a moderate distance (800 meters) from a cooling water pond had an average fluoride concentration of 75 ppm with approximately 58 percent of the fluoride being contained in the grass leaf. Fluoride concentrations in grass samples collected in Gainesville, Florida during this period averaged 8 ppm.

Observed Effects of Fluorides on Livestock: Cattle from three sites were examined in April, 1978, by a veterinarian experienced in the effects of fluorosis (Crum, 1978). The study was made to determine if cattle born and raised near the Occidental site are affected by fluorides in the forage provided them.

The area is utilized primarily for pulpwood production. There are, however, a number of small farms and pasturelands located within a 5-miles radius of the plant. The three sites investigated are shown on Figure 2.2-4.

All cattle examined were raised in the area where they were examined. They had free access to pasture grasses year round and in some cases received locally grown hay and corn as a winter feed supplement.

The cattle were examined to determine if individual animals had consumed excessive fluorides during their early dentition periods (first five years of age) as evidenced by changes in the structure and wear of teeth. Twenty-one animals, ranging in age from 10 months to 13 years, were examined. Eight animals were examined at the south and east sites and five were examined at the southwest site.

The examination showed the greatest effect to be that defined:

> Slight Effect-slight mottling of enamel, best observed as horizontal striations with transmitted light; may have slight staining but no increase in normal rate of wear (National Academy of Sciences, 1974).

This effect was exhibited in a total of nine teeth from six of the 21 animals examined. The number of teeth showing effects in these six animals ranged from one to three.

Table 2.2-6 1977-78 County-wide Carbon Monoxide, Hydrocarbon, and Nitrogen Oxide Burden for Hamilton County, Florida

Source	Pollutant (tons/year) CO	Hydrocarbons	NO_x
Automotive	5001	635	873
Space Heating	1	0	6
Point Sources	53	11	640
Total	5055	646	1519

Note: These estimates based upon EPA document "Compilation of Air Pollutant Emission Factors", Feb. 1976.

The examination further revealed the cattle to be free from skeletal fluorosis. It was concluded that none of the effects were sufficient to cause a loss of productivity.

Effects of Fluorides on Vegetation: Surveys, conducted in the area since 1974, have revealed no significant fluoride effects on vegetation anywhere in the area. The latest survey was conducted in March, 1978. The only effects noted at that time were moderate tip necrosis on a few pine trees located on the dike forming one of the cooling water ponds. Maple, sweet gum, willow and other shrubby material on the dikes showed no fluoride effects. Pine trees, a few hundred meters from the ponds, were normal (Brandt, 1978).

Observations in the vicinity of the Swift Creek site revealed no fluoride effects.

2.2.2.4 Existing Carbon Monoxide, Nitrogen Oxides and Hydrocarbon Burden

The 1977-78 CO, NO_x and hydrocarbon burden in Hamilton County is very small. Because of the small existing burden and the correspondingly small impact on air quality, only the burden of each of these pollutants has been estimated using EPA emission factors (EPA, 1976).

The sources considered were automotive, space heating, and fuel combustion at the Occidental complex. The burden of each of these pollutants for the 1977-78 period is presented in Table 2.2-6.

2.2.3 NOISE STUDY

Noise surveys on three separate dates established average day-night (L_{dn}) noise levels at 40 dB_A for the proposed site of the Swift Creek Chemical Complex. Noise level measurements were made using a Precision Sound Level Meter and the average baseline noise level measured was typical of rural areas. Measurements were also made at the site of the existing Suwannee River Chemical Complex to determine noise levels, frequency spectra and directionality of noise sources similar to those for the proposed complex. The average, continuous, A-weighted level for all noise sources was near 80 dB_A at 50 feet from the source. Sulfuric acid plants were highly directional; 10 dB_A above average at one end of the plant and 10 dB_A below average at the opposite end. All other sources were nondirectional. No pure tone characteristics were detected for any noise source. Attenuation of noise levels was determined to be 6 dB_A for each doubling of distance from the noise source. The data from these measurements provided the basis for prediction of noise levels during operation of the proposed Swift Creek Chemical Complex.

LIST OF REFERENCES
(Section 2.2)

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Crum, J.B. (1978), "Cattle Study - Hamilton County, Florida"; Prepared for Sholtes and Koogler Environmental Consultants, Gainesville, Florida, April 1978.

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National Academy of Sciences (1974), "Effects of Fluorides in Animals: Subcommittee on Fluorosis"; Committee on Animal Nutrition, National Research Council, Washington, D.C.

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2.3 TOPOGRAPHY

2.3.1 GENERAL TOPOGRAPHIC SETTING

Most of Hamilton County including the Occidental property is a moderately flat, poorly drained region that ranges in elevation from about 50 feet (MSL) to about 150 feet (MSL). The county is drained by the Alapaha, Withlacoochee and Suwannee Rivers. The eastern part of the county, where the Occidental property lies, is drained by the Suwannee River.

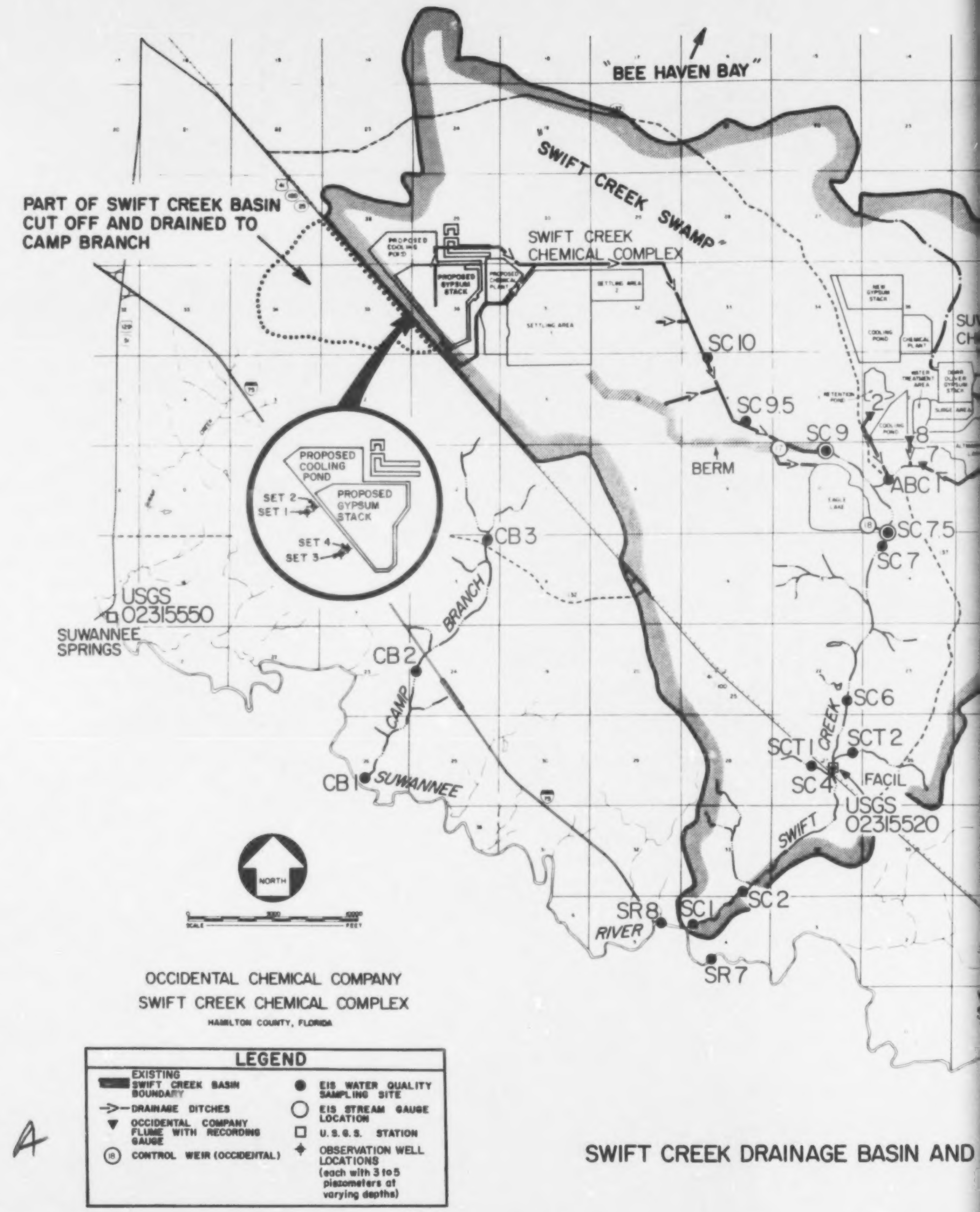
2.3.2 SWIFT CREEK DRAINAGE BASIN

The proposed chemical plant lies within a moderately flat area at approximately Elevation 140 feet (MSL) on the west side of the water shed of Swift Creek, a tributary of the Suwannee River. A map of the Swift Creek drainage basin is shown in Figure 2.3-1.

The northwest half of the drainage area is dominated by a regional surficial depression, "Swift Creek Swamp", which is located approximately 120 feet above mean sea level and forms the headwaters of Swift Creek.

The channel of Swift Creek falls at an average rate of 7.5 feet per mile for 5 miles, then plunges in the last 2 miles at a rate of approximately 17 feet per mile to the Suwannee River, which lies at an elevation of about 50 feet (MSL). The channel varies in depth from 5 to 8 feet near the headwaters to as much as 50 feet as it approaches the Suwannee River.

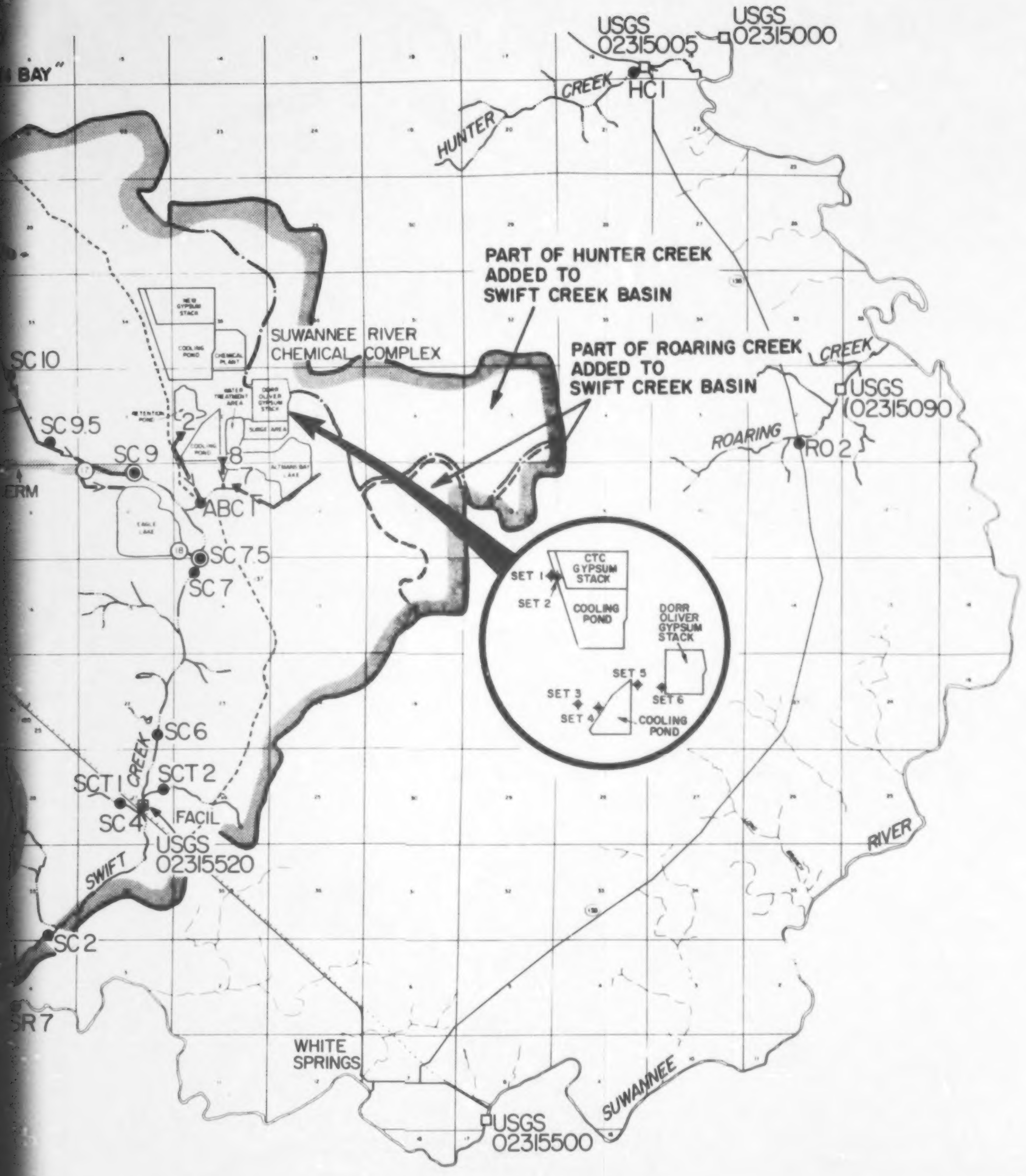
The drainage area of Swift Creek has undergone certain natural and man-made changes. During mining operations certain areas have been added or occluded from natural drainage, as shown in Figure 2.3-1. A large part of the intercepted runoff is recirculated in the mining systems, evaporated and/or tied up in phosphatic clays. The remainder is released to Swift Creek. Occidental's reclamation plans are such that, after mining, there will be no significant change to the natural drainage boundaries of the area streams and creeks.


"BEE HAVEN BAY"
"SWIFT CREEK SWAMP"
PART OF SWIFT CREEK BASIN CUT OFF AND DRAINED TO CAMP BRANCH
SWIFT CREEK CHEMICAL COMPLEX
PROPOSED COOLING POND
PROPOSED GYPSUM STACK
PROPOSED CHEMICAL PLANT
SETTLING AREA 1
SETTLING AREA 2
NEW GYPSUM STACK
COOLING POND
CHEMICAL PLANT
WATER TREATMENT AREA
DORR OLIVER GYPSUM STACK
RETENTION POND
SURGE AREA
EAGLE LAKE
SET 2
SET 1
SET 4
SET 3
SC 10
SC 9.5
SC 9
BERM
ABC 1
SC 7.5
SC 7
2
8
7
CB 3
CB 2
CB 1
CAMP
BRANCH
SUWANNEE
RIVER
USGS 02315550
SUWANNEE SPRINGS
SC 6
SCT 2
SCT 1
CREEK
SC 4
FACIL
USGS 02315520
SWIFT
SC 2
SC 1
SR 8
SR 7
NORTH
0
5000
10000
SCALE
FEET
LEGEND
EXISTING SWIFT CREEK BASIN BOUNDARY
DRAINAGE DITCHES
OCCIDENTAL COMPANY FLUME WITH RECORDING GAUGE
CONTROL WEIR (OCCIDENTAL)
EIS WATER QUALITY SAMPLING SITE
EIS STREAM GAUGE LOCATION
U.S.G.S. STATION
OBSERVATION WELL LOCATIONS (each with 3 to 5 piezometers at varying depths)

OCCIDENTAL CHEMICAL COMPANY
SWIFT CREEK CHEMICAL COMPLEX
HAMILTON COUNTY, FLORIDA

A

SWIFT CREEK DRAINAGE BASIN AND


USGS
02315005
USGS
02315000
BAY"
HC1
CREEK
HUNTER
PART OF HUNTER CREEK
ADDED TO
SWIFT CREEK BASIN
NEW GYPSUM STACK
COOLING POND
CHEMICAL PLANT
SUWANNEE RIVER
CHEMICAL COMPLEX
WATER TREATMENT AREA
DORR OLIVER GYPSUM STACK
SURGE AREA
RETENTION POND
COOLING POND
ALTAMAHA BAY LAKE
EAGLE LAKE
PART OF ROARING CREEK
ADDED TO
SWIFT CREEK BASIN
CREEK
USGS
02315090
ROARING
RO 2
SC 10
SC 9.5
SC 9
2
8
7
ABC 1
ERM
SC 7.5
SC 7
CTC GYPSUM STACK
SET 1
SET 2
COOLING POND
DORR OLIVER GYPSUM STACK
SET 5
SET 3
SET 4
SET 6
COOLING POND
SC 6
CREEK
SCT 2
SCT 1
SC 4
FACIL
USGS
02315520
SWIFT
SC 2
SR 7
RIVER
WHITE
SPRINGS
SUWANNEE
USGS
02315500

EK DRAINAGE BASIN AND LOCATION OF SAMPLING STATIONS

B

FIGURE 2.3-1

2.4 GEOLOGY

2.4.1 PHYSIOGRAPHY

The regional geologic setting is within two distinct physiographic divisions, the Northern Highlands and the Coastal Lowlands. Because of the presence of low permeability clastic surficial sediments, sinkholes are uncommon in the highlands and shallow, low velocity streams have developed to carry the surface water runoff. Limestone is close to the surface in the Coastal Lowlands and the density of sinkholes is high, especially in the channel of the Suwannee River. The Occidental Chemical Company site is located within the Northern Highlands.

2.4.2 STRATIGRAPHY

2.4.2.1. Regional Stratigraphy

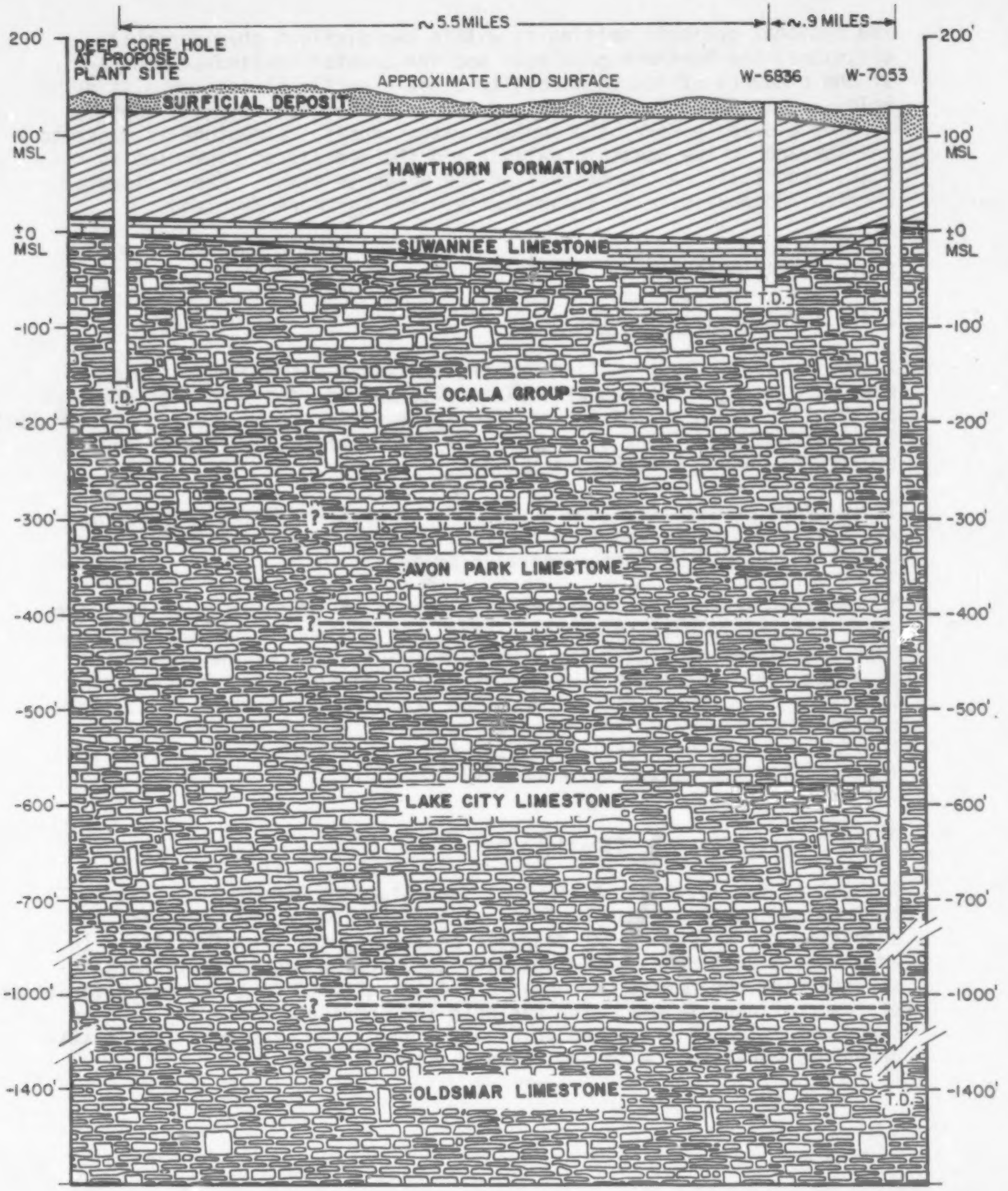
A stratigraphic cross-section constructed using the geologic log of a deep core hole at the proposed plant site and the geologic logs prepared by the Florida Bureau of Geology for two existing wells located approximately 5 miles due east of the site shows the approximate thickness of the sedimentary units (see Figure 2.4-1).

The various marine limestone formations beneath the Hawthorn Formation are highly permeable and form the Floridan Aquifer, the primary source of water for most of North-Central Florida.

The Hawthorn Formation is primarily composed of layers of grey to green, sandy phosphatic clay, phosphatic sand, and phosphatic limestone. The upper portions, generally above 90 feet (MSL), contain the commercial phosphate deposits. The lower, more clayey portions, act as confining beds separating the surficial deposits from the Floridan Aquifer. As can be seen, the Hawthorn Formation, which separates the Floridan Aquifer from the surficial deposits, has a total thickness of over 100 feet beneath the Occidental property.

2.4.2.2 Site Specific Stratigraphy

A total of ten 100-foot to 160-foot deep Standard Penetration Test (SPT) borings and numerous shallow SPT borings (<50 feet deep) were made to determine the nature of the deposits underlying the proposed site. In addition, a continuous, 300-foot deep core boring was made at the site to determine the formation contacts and to better define the characteristics of the confining layers. The geologic log and a gamma ray log for the deep core hole are presented in Figure 2.4-2. The site specific stratigraphy is consistent with the regional stratigraphy.


~5.5 MILES
~.9 MILES
200'
DEEP CORE HOLE AT PROPOSED PLANT SITE
APPROXIMATE LAND SURFACE
W-6836
W-7053
200'
SURFICIAL DEPOSIT
100' MSL
100' MSL
HAWTHORN FORMATION
±0 MSL
±0 MSL
SUWANNEE LIMESTONE
T.D.
-100'
-100'
T.D.
OCALA GROUP
-200'
-200'
?
-300'
-300'
AVON PARK LIMESTONE
?
-400'
-400'
-500'
-500'
-600'
LAKE CITY LIMESTONE
-600'
-700'
-700'
?
-1000'
-1000'
-1400'
OLDSMAR LIMESTONE
T.D.
-1400'

GEOLOGIC SECTION AT THE STUDY SITE

FIGURE 2.4-1

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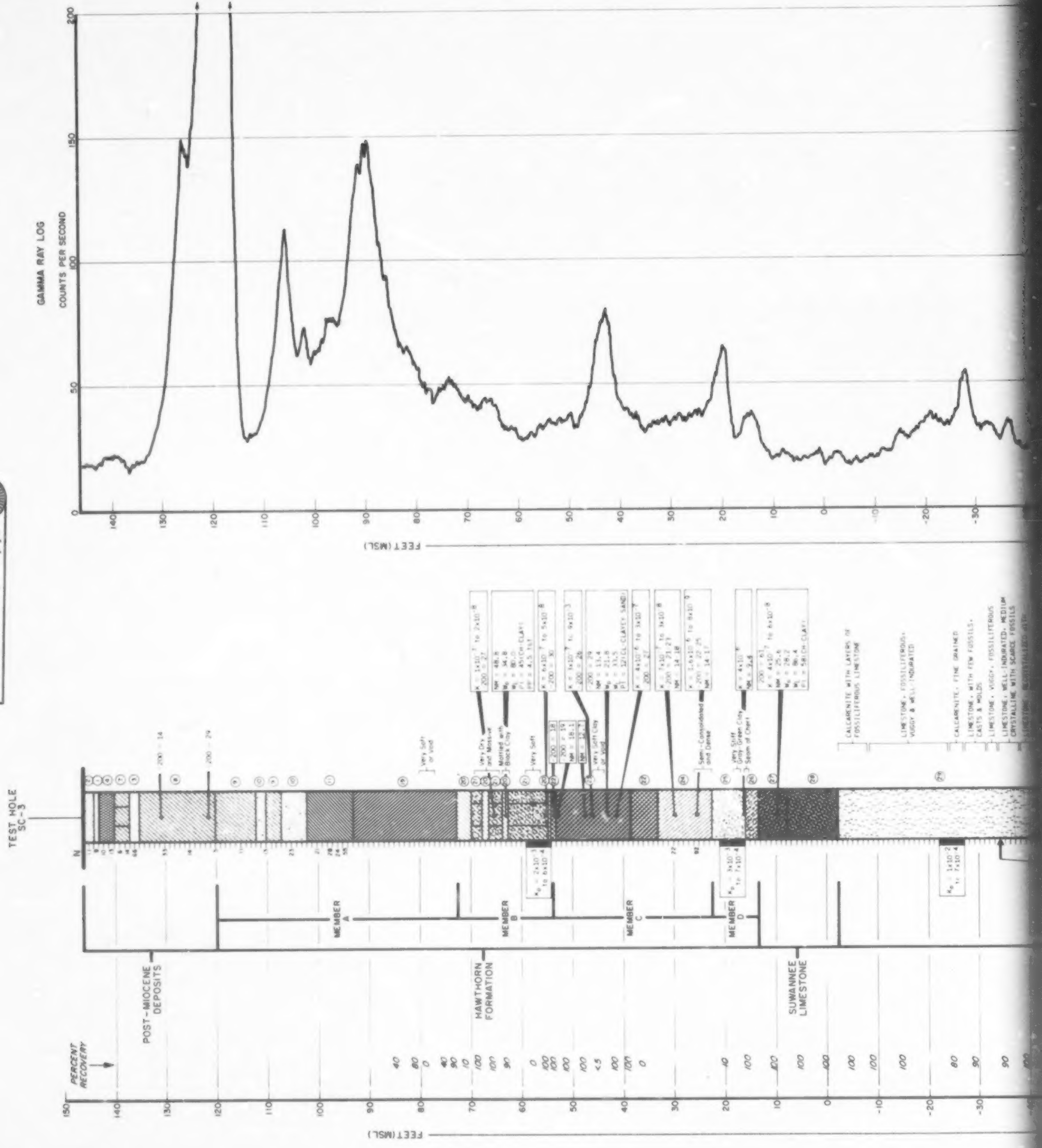

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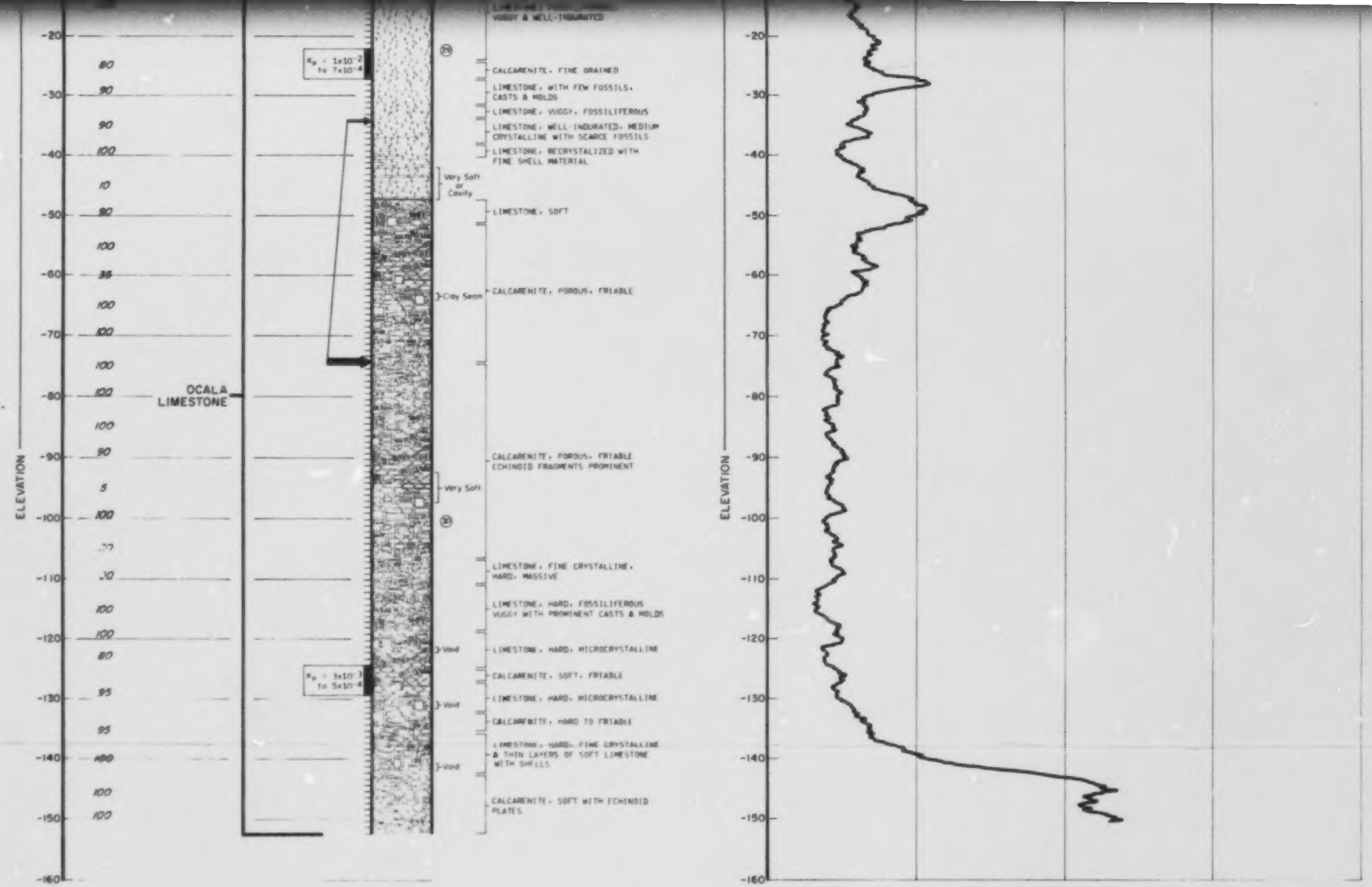


LEGEND

☐ ① GRAY TO DARK GRAY FINE SAND WITH ROOTS (TOPSOIL)
☐ ② MIXED BROWN AND GRAY FINE SAND (FILL)
☐ ③ LIGHT GRAY FINE SAND
■ ④ LIGHT REDDISH BROWN AND DARK BROWN FINE SAND (HARDPAN TYPE)
▩ ⑦ BROWN TO GRAYISH BROWN SILTY TO SLIGHTLY CLAYEY FINE SAND
▨ ⑧ LIGHT BROWNISH GRAY CLAYEY FINE SAND MOTTLED ORANGISH BROWN FINE SAND
☐ ⑨ GRAYISH BROWN SLIGHTLY CLAYEY TO CLAYEY FINE SAND WITH OCCASIONAL PHOSPHATE
☐ ⑩ GREENISH GRAY SAND WITH PHOSPHATE (MATRIX)
■ ⑮ YELLOWISH GRAY CLAY TO CONSOLIDATED CLAY WITH SEAMS OF SAND MIXED WITH PHOSPHATES
■ ⑲ DARK GRAY TO BLUE GRAY MEDIUM TO SOFT LIMESTONE WITH FOSSILS (FOSSILIFEROUS) AND SOME PHOSPHATE INTERBEDDED WITH BLUE GRAY TO GREEN GRAY LAYERS OF SOFT CLAY RANGING IN THICKNESS FROM 0.5FT. TO 4FT. AND AVERAGING ABOUT 1FT.
☐ ⑳ PALE GREEN TO BLUE GREEN PLASTIC CLAY
▩ ㉑ LIGHT GRAY TO LIGHT BLUE GRAY CRUMBLY SOFT TO MEDIUM LIMESTONE WITH SHELLS AND TRACES OF PHOSPHATE INTERBEDDED WITH THICK LAYERS OF PALE GREEN TO BLUE GREEN MASSIVE CLAYEY SILT AND CLAYEY FINE SAND
▩ ㉒ TAN TO PALE GREEN CLEAN TO SLIGHTLY CLAYEY FINE SAND
■ ㉓ CREAM TO WHITE SOFT RUBBLY LIMESTONE THICKLY INTERBEDDED WITH LAYERS AND TIGHTLY FILLED WITH SEAMS OF BLUE GREEN TO GREENISH CLAY AND CLAYEY FINE SAND; ALSO BLUE GREEN TO GREEN CLAYEY SANDS AND SANDY CLAYS WITH THIN SEAMS OF SANDS AND SOFT CLACAREOUS ROCK
☐ ㉔ LIGHT GREEN TO LIGHT GRAY CLAYEY FINE SAND
☐ ㉕ LIGHT GRAY FINE GRAINED SANDSTONE, WELL INDURATED AND CALCAREOUS
▩ ㉖ GREEN GRAY MOTTLED CLAY AND SANDS, CALCAREOUS, WITH GRAY TO WHITE SANDY LIMESTONE, SOFT TO INDURATED
■ ㉗ LIGHT GRAY SOFT LIMESTONE, SANDY, MEDIUM CRYSTALLINE WITH PROMINENT SEAMS AND POCKETS TIGHTLY FILLED WITH STIFF GREEN CLAY
■ ㉘ LIGHT GRAY MEDIUM TO HARD LIMESTONE, FOSSILIFEROUS, WITH OCCASIONAL THIN SEAMS OF GREEN CLAY
☐ ㉙ LIGHT GRAY TO WHITE SOFT CALCARENITE AND GRAY TO OFF-WHITE MEDIUM TO HARD LIMESTONE WITH OCCASIONAL THIN SEAMS OF GREEN CLAY
■ ㉚ LIGHT GRAY TO WHITE MEDIUM TO HARD LIMESTONE AND DARK GRAY TO WHITE SOFT, FRIABLE TO HARD CALCARENITE

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT
K COEFFICIENT OF PERMEABILITY, cm/sec
K_p COEFFICIENT OF PERMEABILITY, cm/sec FROM PACKER TESTS
NM NATURAL MOISTURE IN PERCENT
W_p PLASTIC LIMIT IN PERCENT
W_L LIQUID LIMIT IN PERCENT
PI PLASTICITY INDEX
PP POCKET PENETROMETER UNCONFINED STRENGTH
-200 PERCENT PASSING NO. 200 SIEVE
→ BEGIN DRILLING FLUID LOSS
➡ COMPLETE DRILLING FLUID LOSS

B

GEOLOGIC LOG OF DEEP CORE HOLE AT SWIFT CREEK CHEMICAL COMPLEX SITE

FIGURE 2.4-2

2.4.3 SITE SUSCEPTIBILITY TO SINKHOLES

The site is located along the western perimeter of an area identified by the Florida Geological Survey as least probable for sinkhole activity.

2.4.4 EARTHQUAKE SUSCEPTIBILITY

Florida has experienced no damaging earthquakes. However, several ground movements of Intensity V and VI (minor damage) on the Modified Mercalli scale have been experienced in north Florida.

2.5 SOILS

2.5.1 GENERAL DESCRIPTION

The surface soils of Hamilton County range from sloping well-drained sands to nearly level very poorly drained sandy soils. The more well-drained soils generally occur west of the Alapaha River and southwest of Jasper. Slightly sloping to nearly level, somewhat poorly to very poorly drained soils dominate the eastern portion of Hamilton County, where the site is located.

There are several major soil associations in the Swift Creek Drainage Basin. The proposed plant will be constructed within the Leon-Mascotte-Rutlege Association. The major soil series comprising this association generally consist of a three to five foot thick layer of slightly silty fine sands overlying clayey sands. These soils are characterized by a low shrink-swell potential, low dust and erosion potential, and a water table that is within one foot of the surface during the wet season. A more detailed discussion of the surficial soils and post-mining soil characteristics is given in Section 2.5 of the Resource Document.

2.5.2 AGRICULTURAL USES

The USDA Soil Conservation Service divides soils into 8 classifications of suitability for cropland and pastureland. Those range from Capability Class I, which has few limitations for agricultural purposes, to Capability Class VIII, which is unsuitable for commercial plants. At the site, the major soil series comprise the Leon-Mascotte-Rutlege Association having capability units ranging from IIIw to IVw. These are moderately suitable soils limited in usage because of poor drainage and a high water table.

2.6 HYDROLOGY

2.6.1 HYDROLOGIC CYCLE

Specific data on various phases of the hydrologic cycle are essential for establishing background conditions and assessing the impacts of the proposed facility. The main water input is from precipitation supplemented by surface water and groundwater inflow. Outputs from the system consist of open-water evaporation, evapo-transpiration from soil and vegetation, surface runoff, base flow into streams, recharge to the underlying aquifers and groundwater outflow from the aquifer system.

Section 2.1 of the Resource Document summarizes relevant climatological and meteorological data for the site. The difference in the long-term average rates of precipitation and evapo-transpiration, equaling approximately 11 to 14 inches per year, consists of surface runoff, water exiting as base flow into creeks and water entering and recharging the underlying aquifers (which amount is controlled by the leakance and head difference across confining beds). Runoff in Hamilton County generally exceeds 10 inches per year but may be subject to significant local and yearly variations.

2.6.2 SURFACE WATER QUANTITY

The proposed plant site lies on the west side of the Swift Creek drainage basin. Swift Creek is a tributary to the Suwannee River, the major river drainage in this section of North Florida. The flow characteristics of both the Suwannee River and Swift Creek are important environmental considerations.

2.6.2.1 Suwannee River Flows

The Suwannee River has its headwater in Georgia in the Okefenokee Swamp and flows south to White Springs, Florida where it turns west, then winds its way south to the Gulf of Mexico. At White Springs, the river drains 2,430 square miles, with approximately half the drainage area flow originating in Georgia. The flow up to this point is composed almost entirely of swamp drainage. At White Springs, the river starts to pick up large amounts of base flow from numerous limestone springs, and the character of the water, as well as flow conditions, change significantly. Since 1969, the records at White Springs indicate a maximum daily flow of as much as 38,000 cfs, a low flow of about 30 cfs, and an average flow of about 1,880 cfs.

The flow of the Suwannee River has been measured by the United States Geological Survey (USGS) at Station 02315500, Suwannee River at White Springs, just upstream from the Swift Creek confluence, since 1927. The monthly and yearly flow statistics for this station are presented in Table 2.6-1. Other principal long-term streamflow characteristics for

TABLE 2.6-1

FLOW PARAMETERS OF SUWANNEE RIVER AND PRINCIPAL TRIBUTARIES

USGS Station Number	Location	River Mile+	Drainage Area* Sq Mi	Central Values (cfs)			Low Flows (cfs)**				Peak Flows (cfs)***			
				Average Flow	Median Yearly	Median Daily	M7,2	M7,10	M30,2	M30,10	Q_2	Q_5	Q_{25}	Q_{100}
02314500	Suwannee River at Fargo Georgia	222	1200	1104	1024	195	69	1.2	110	3.2	4270	8020	14800	20900
	Suwannee River above Rocky Creek	199.4	2015	1640	1440	430	23	1.5	65	4	7570	13400	21700	22600
02314986	Rocky Creek near Belmont, Florida	199.1	71.0	31	20		.02-.04	0	0.6-.7	0	855	1620	3530	5900
	Rocky Creek at mouth	199.1	71.6	31	20		.04-.05	0	0.8-1.0	0	922	1690	3680	6150
02315000	Suwannee River near Benton, Florida	196.5	2090	1670	1460	440^e	23^e	1.5^e	66	4	7670	13600	20000	27800
02315500	Suwannee River at White Springs, Florida	171.8	2430	1879	1599	500	54.6	9.9	97	15.4	8130	14400	23300	29400
	Suwannee River above Swift Creek	162.8	2490	1935^e	1710^e	550^e	80^e	22^e	130^e	30^e	8200	14500	23500	29700
02315520	Swift Creek at Facil, Florida	162.8	37.9	31	23	8	1 - 2	0 - .2	2 - 3	.3 - .5	710	1300	2840	4740
	Swift Creek at mouth	162.8	41.9	35	26	10	4 - 5	0 - .4	4 - 6	.5 - .7	836	1530	3340	5580
02315550	Suwannee River at Suwannee Springs, Fla.	150.3	2630	2020	1795	650^e	144^e	65^e	290^e	78^e	8370	14800	24000	30300
	Suwannee River above Alapaha River	134.8	2690	2500^e	1840^e	1300^e	300^e	150^e	400^e	200^e	9500^e			
02317500	Alapaha River near Statenville, Georgia	138.4	1400	1032	912	360	50	25	62	30	5060	9110	16700	24200
	Alapaha River at mouth	138.4	1840	800±300	--	--	0	0	0	0	5060^e			
	Suwannee River above Withlacoochee River	127.2	4610	4600^e	4200^e	3600^e	1370^e	910^e	1620^e	940^e	12000^e			
0231900	Withlacoochee River at Pinetta, Florida	127.2	2120	1666	1444	600	139	89.2	160	96	9320	19000	40700	65700
	Withlacoochee River at mouth	127.2	2360	1900^e	1650^e	680^e	155^e	100^e	190^e	110^e	9700^e			
02319500	Suwannee River at Ellaville, Florida	127.0	6970	6548	5843	4300	1530	1010	1890	1050	18300	33000	61400	90100
02320000	Suwannee River at Luraville, Florida	98.0	7330	6670^e	6140^e	4600^e	2030	1360	2320	1400	17000			
02320500	Suwannee River at Branford, Florida	76.0	7880	6960	6363	4900	2367	1673	2700	1770	16200	27500	48100	68300
	Suwannee River above Santa Fe River	65.7	7970	7120	6500^e		2600^e	1900^e	3000^e	2000^e	15000^e			
02322500	Santa Fe River at Ft. White, Florida	65.7	1017	1637	1477	1170	959	716	1020	754	4240	7100	12200	16900
	Santa Fe River at mouth	65.7	1380	2300	2000^e		1300^e	1000^e	1400^e	1100^e	4800			
02323500	Suwannee River near Wilcox, Florida	33.5	9640	9980^f	9100^e	7500^e	4970	3682	5400^e	4200^e	17100	27600	46500	64900

+Based on Corps of Engineers

*Areas of the Suwannee River are all approximate because of indeterminant area of Okefenokee Swamp at its origin.

^{e}Estimated.

^{f}Adjusted to equivalent 46-year average including 1932-41.

**The first numeral refers to the duration in days, the second to the recurrence interval in years. For example, M7,10 is the 7-day flow to which flows will recede once in 10 years.

***The numeral refers to the recurrence interval in years. For example, Q_{25} is the peak flow which has a probability of occurence once every 25 years, i.e., flows equal to or larger than this flow will occur on the average once every 25 years.

the Suwannee River and its main tributaries are also presented in this table. Swift Creek, the Alapaha River, the Withlacoochee River and the Santa Fe River flows represent approximately 0.5, 8, 19 and 23 percent, respectively, of the Suwannee River flow near Wilcox, Florida.

2.6.2.2 Swift Creek Flows

Runoff in Swift Creek, as in most area streams, varies significantly in response to variations in rainfall. Miscellaneous discharge measurements have been made since 1969 and daily discharge records were collected starting May, 1976 at the USGS Gauging Station 02315520, Swift Creek at Facil. These records reflect current mining operations and do not correlate well with records for nearby gauged streams of similar hydrologic characteristics. Therefore, use was made of correlations of the available data with concurrent records of the difference in the flows recorded at Suwannee River near White Springs, Florida and Suwannee River at Fargo, Georgia, in order to establish long-term natural streamflow characteristics for Swift Creek.

2.6.2.2.1 Natural Flows of Swift Creek

Based on the above correlations, the natural average flow of Swift Creek prior to development was estimated at 0.8 cubic feet per second per square mile (cfs per mi^2). The flow is assumed to be distributed in time the same as the difference in flows between the Suwannee River at White Springs, Florida and Fargo, Georgia. Table 2.6-1 presents the generated natural flow parameters for 43 years based on this estimate.

2.6.2.2.2 Effect of Mining Operations on the Average and Low Flows of Swift Creek

The actual measured flows at the USGS gauge, Swift Creek at Facil, indicate a maximum daily discharge of about 1,200 cfs and a minimum of about 2 cfs. Swift Creek is a partially controlled discharge stream and hence its measured averages do not reflect natural flow conditions. The storm-runoff patterns are not readily apparent from recorded discharge data because the artificial discharges maintain the flow at relatively high levels even during the dry season and occasional curtailment of releases provides misleading reductions in flow.

Under current conditions, the measured flows do not include natural flow that would normally run off from areas occluded from Swift Creek. The overall effects of occlusion of certain areas from natural drainage (reduction of 6 to 11 cfs) and augmentation by nonprocess water releases (31 cfs) appear to provide an average increase of 20 to 25 cfs for conditions existing during the period of data collected for Swift Creek. This would indicate a long-term average flow of about 50 to 55 cfs for the USGS Gauging Station at Facil for current conditions. At times when the plant had shut down, USGS records showed sudden reductions of flow of up to 40 cfs. This comparison does not provide a check of the estimated long-term flow but does provide a rough check that the above estimates are in the correct range.

The lowest flows in Swift Creek will occur when the plants are not operating or when the discharge is curtailed. Estimates of the natural 7-day and 30-day low flows are presented in Table 2.6-1. These estimates will have to be increased by the discharges from Occidental operations during drought periods. It is unlikely that Occidental would not curtail its discharges to conserve water required in the circulation system during droughts.

2.6.3 GROUNDWATER QUANTITY

2.6.3.1 Hydrogeologic Setting

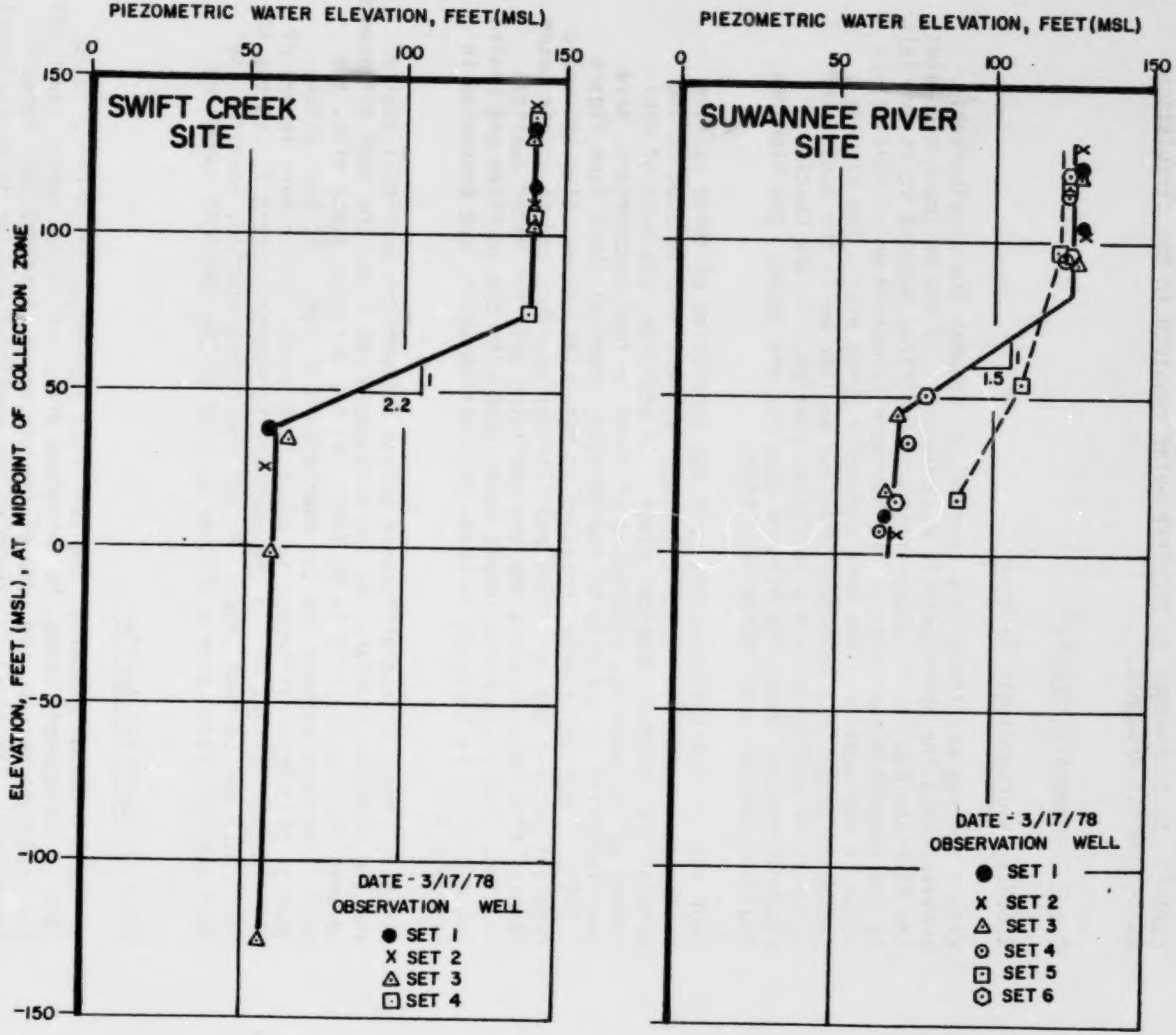
Within the region, there is a correlation between the physiographic provinces and the hydrogeologic environment. In the Northern Highlands, the Floridan Aquifer is under artesian conditions because it is overlain by low permeable sediments of the Hawthorn Formation which confine the water in the aquifer. The more permeable zones within the Miocene sediments comprise a secondary artesian aquifer while the sands overlying these sediments form a surficial aquifer. In the Coastal Lowlands region, where the Miocene deposits are absent, the Floridan Aquifer is under water-table conditions.

Four sets of monitoring wells, each set consisting of three to five piezometers installed at different depths, have been located at the site of the proposed chemical plant. In addition, six sets of monitoring wells, each set consisting of three to four piezometers, have been installed at the site of the existing chemical plant (see Figure 2.3-1). These wells were installed to determine the existing hydraulic gradient between the surficial and Floridan aquifers and to obtain water samples from both aquifers and the confining unit for water quality testing. The piezometric levels associated with the aquifers and confining deposits, as measured in these observation wells, are presented in Figure 2.6-1.

At both sites, a head difference exists between the surficial aquifer and the Floridan Aquifer. At the proposed plant site, the head difference between the two aquifers is 80 feet. At the existing plant site, the head difference between the two aquifers is 57 feet. At both sites, most of this head difference is dissipated across one or more layers of plastic clay present within the Hawthorn Formation between Elevations 40 feet (MSL) and 85 feet (MSL). At one monitoring station, however, the head was dissipated over a thicker section of the Hawthorn Formation.

2.6.3.2 Surficial Aquifer

On the Occidental property, the surficial aquifer consists of: 3 to 15 feet of Pleistocene sands, Post-Miocene silty and clayey sands, sands of the phosphate matrix, and some of the weathered limestone just beneath the matrix. The total thickness of the surficial aquifer is approximately



PIEZOMETRIC LEVELS AT VARIOUS DEPTHS IN GEOLOGIC PROFILE

FIGURE 2.6

40 feet at the existing plant site and approximately 60 feet at the proposed plant site.

The water level in the surficial aquifer is a subdued reflection of the topography. The water table is at or within a few feet of the ground surface, and fluctuates on the order of several feet per year in response to water inputs and outputs. Recharge is primarily from precipitation and water outputs include evapo-transpiration, groundwater flow to streams, lakes or swamps, and recharge to the underlying Floridan aquifer. Because of the low hydraulic gradients arising from the low degree of topographic relief, lateral flow of the surficial groundwater is localized.

The results from a pumping test performed at the proposed plant site indicate that the post-Miocene silty and clayey sands act as a semi-confining bed with a leakance of about 0.17 day^{-1}, and that the transmissivity of the layers beneath the semi-confining bed is on the order of 500 ft^2/day. Wells tapping the surficial aquifer typically yield less than 50 gallons per minute.

2.6.3.3 Hawthorn Confining Unit and Secondary Artesian Aquifer

The Hawthorn confining unit consists of plastic clays, clayey sands, sandstone and limestone. The clay layers impede the downward movement of water. Permeable zones composed of sand and/or limestone found within the Hawthorn Formation form a minor secondary artesian aquifer. The secondary artesian aquifer is not areally extensive and wells tapping the aquifer generally yield less than 50 gpm.

At the Occidental site in Hamilton County, the Hawthorn Formation is approximately 100 feet thick. No permeable zones were found within the Hawthorn confining unit that are of sufficient thickness to be considered an aquifer.

As part of its investigation in the Osceola National Forest, some twenty miles southeast of the Occidental site, the USGS determined a maximum value of 0.30 inches per year for the annual recharge rate through the Hawthorn confining unit (Miller et al, 1977).

At the Osceola site, the Hawthorn Formation contains two identifiable confining units. At the proposed plant site, only one of these units (Member B) is present. The leakage coefficient for Member B at the Osceola site, based on the above recharge rate, was found equal to 3.6 $\times 10^{-6}$ day^{-1}. This value agrees very well with a value of 2.9 $\times 10^{-6}$ day^{-1}, calculated using results from laboratory permeability tests performed on samples from the clayey layers obtained from the core boring drilled at the proposed plant site.

2.6.3.4 Floridan Aquifer

The Floridan Aquifer is the primary source of groundwater in the area. The Floridan Aquifer is under artesian conditions in the Northern Highlands and under water-table conditions in the Coastal Lowlands. In the Northern Highlands, the primary water inputs are groundwater recharge from the surficial aquifer by leakage through the Hawthorn confining unit and groundwater inflow from upgradient areas. The water outputs include groundwater discharge to surface-water bodies, groundwater withdrawals and groundwater underflow to downgradient areas.

As discussed in the Resource Document, the major discharge from the Floridan Aquifer is into the Suwannee River, particularly downstream of White Springs.

Area pumping tests suggest that the transmissivity of the Floridan aquifer is on the order of 66,000 ft^2/day and that the storage coefficient is about 0.0001 (Miller et al, 1977).

2.6.3.5 Effect of Mining Operations on Groundwater Flows

Phosphate mining operations in Hamilton County have impacted and will continue to impact the hydrologic system. These activities alter the stratigraphy of the surficial aquifer and cause localized changes in the direction and amount of groundwater flow around mining areas. The topography is altered from flat to gently rolling and the reclaimed land is less stratified and looser than it was prior to mining. In addition, the number of surface water-bodies is increased by the creation of lakes and the presence of mined-out pits. In areas of active mining, the water-table is lowered due to dewatering. Upon reclamation, the water-table recovers to reflect the gently rolling topography.

Occidental Chemical Company currently withdraws approximately 30 MGD from the Floridan Aquifer for its mining and processing facilities. Eight industrial supply wells withdraw groundwater needed at the Suwannee River Chemical Complex, Suwannee River Mine and Swift Creek Mine. Miller et al (1977) analyzed long-term records from an observation well in Jennings, a well 3.5 miles west of White Springs, a well in Lake City and a well near Valdosta, Georgia. They concluded that pumping by Occidental Chemical Company has not produced a regional decline in the potentiometric surface.

2.6.4 SURFACE WATER QUALITY

2.6.4.1 General Setting

The Suwannee River is an acidic system for most of its length in Florida due to high levels of organic acids derived from its headwaters in the Okefenokee Swamp and run-off from forests and swamps as it flows to the Gulf. Water from the aquifer enters the Suwannee River along most of its length. Below White Springs, springs are particularly common and important modifiers of water quality.

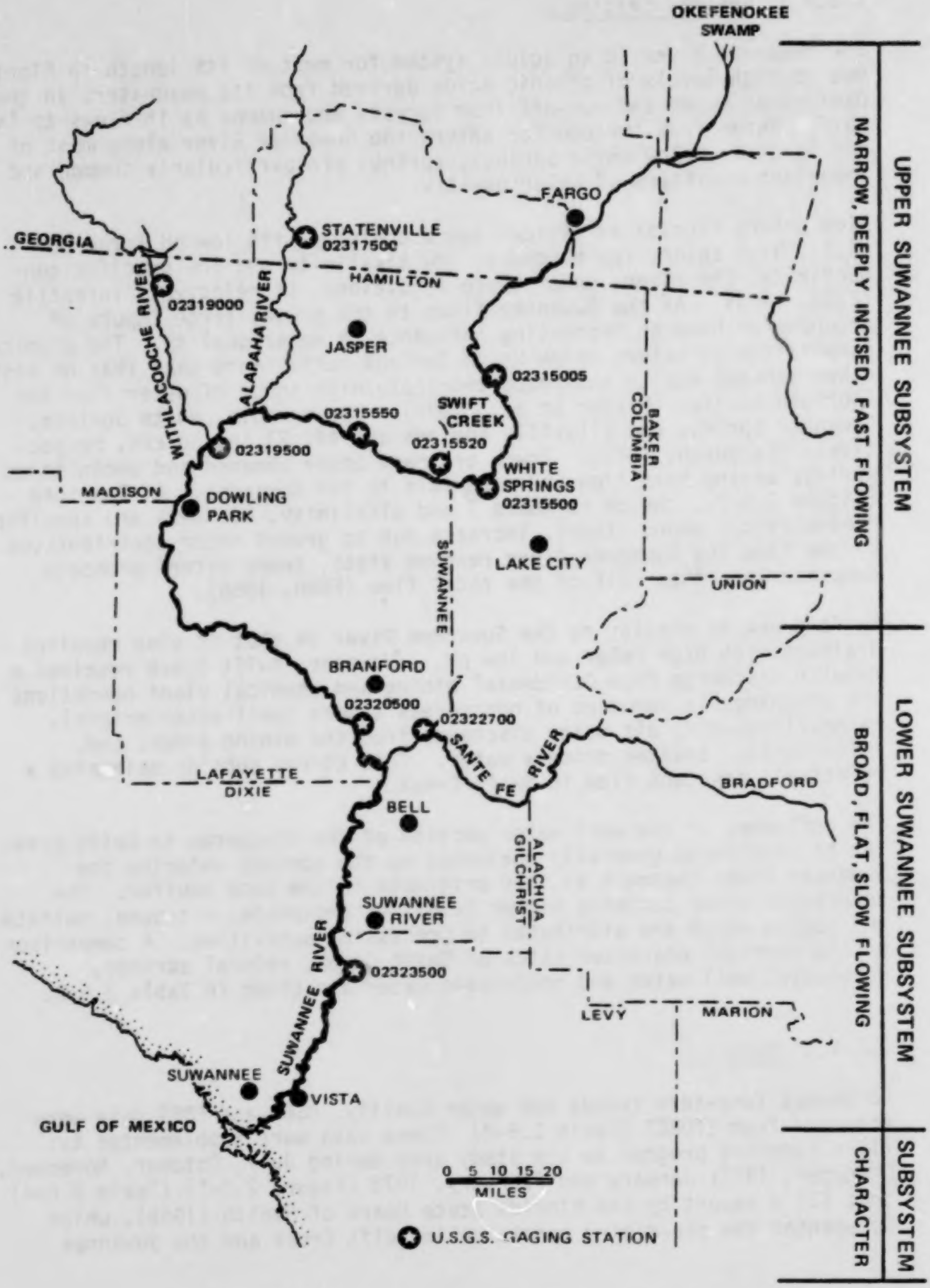
Flow enters Florida as typical swamp drainage with low pH (mean pH ≈4.5), high color, low hardness, low alkalinity and low specific conductivity. The river, under these conditions, is relatively infertile (FSBH, 1966). As the Suwannee flows to the south, large inputs of groundwater have an increasing influence on water quality. The chemical composition of waters below White Springs varies more than that of most other streams due to the proportionately high input of water from the Floridan Aquifer (Miller et al., 1977). For example, White Springs, Suwannee Springs and Ellaville Springs add 44, 23 and 50 cfs, respectively (Ferguson, 1947). There are many other unnamed and unmonitored springs adding both flow and materials to the Suwannee. At Branford (Figure 2.6-2), the pH is above 7 and alkalinity, hardness and specific conductivity, among others, increase due to ground water contributions. By the time the Suwannee River reaches Vista, swamp waters probably comprise less than half of the total flow (FSBH, 1966).

Swift Creek is similar to the Suwannee River in that it also receives drainage with high color and low pH. However, Swift Creek receives a regular discharge from Occidental mining and chemical plant operations. The discharge is composed of nonprocess waters (well water origin), rainfall run-off, pit water discharge from the mining areas, and, infrequently, treated process water. This stream subsidy maintains a relatively constant flow in Swift Creek.

The influence of the well water portion of the discharge to Swift Creek can be considered generally analogous to the springs entering the Suwannee River inasmuch as they originate in the same aquifer. The nonprocess water contains higher levels of phosphate, nitrogen, sulfate and sodium which are attributed to processing activities. A comparison of the chemical characteristics of Swift Creek, natural springs, Occidental well water and nonprocess water are given in Table 2.6-2.

2.6.4.2 Data

To assess long-term trends and water quality, USGS and FDER data were obtained from STORET (Table 2.6-3) These data were supplemented by: (1) a sampling program in the study area during July, October, November, December, 1977; January and February, 1978 (Figure 2.7-1) (Table 2.6-4) and; (2) a report by the Florida State Board of Health (1966), which documented the pre-mining condition in Swift Creek and the Suwannee


OKEFENOKEE SWAMP
FARGO
STATENVILLE 02317500
GEORGIA
HAMILTON
WITHLACOOCHEE RIVER
02319000
ALAPAHA RIVER
JASPER
02315005
SWIFT CREEK
02315550
02315520
02319500
WHITE SPRINGS 02315500
BAKER
COLUMBIA
MADISON
DOWLING PARK
LAKE CITY
UNION
SUWANNEE
BRANFORD
02320500
02322700
SANTE FE RIVER
LAFAYETTE
DIXIE
BRADFORD
BELL
ALACHUA
GILCHRIST
SUWANNEE RIVER
SUWANNEE RIVER
02323500
LEVY
MARION
SUWANNEE
VISTA
GULF OF MEXICO
0 5 10 15 20
MILES
U.S.G.S. GAGING STATION
UPPER SUWANNEE SUBSYSTEM
NARROW, DEEPLY INCISED, FAST FLOWING
LOWER SUWANNEE SUBSYSTEM
BROAD, FLAT, SLOW FLOWING
SUBSYSTEM
CHARACTER

U.S.G.S. STATIONS IN THE SUWANNEE RIVER BASIN

FIGURE 2.6-2

Table 2.6-2 Comparison of Swift Creek, Rocky Creek, White Springs Groundwater, Occidental Deep Wells and Nonprocess Water for Selected Chemical Parameters

Parameter	Stream		Groundwater from White Springs	Typical OXY Deep Wells [4]		Typical Nonprocess Water	
	Swift Creek	Rocky Creek		(min)	(max)	(min)	(max)
Specific conductivity (μmhos/cm)	456.25^1	86.68^1	275.00	329.00	528.00	493.00	965.00
Organic nitrogen	0.94^1	1.06^1	0.22	---		0.40	0.60
Ammonia nitrogen	5.60^1	0.06^1	0.18	---		13.00	37.80
Nitrate nitrogen	1.73^1	< 0.01^1	< 0.01	0.15	0.36	0.60	1.20
Ortho phosphate as P	32.97^1	0.17^1	0.12	0.05	0.36	---	
Total phosphate as P	18.50^1	0.01^1	0.14	---		2.50	17.00
Total organic carbon	18.48^1	51.16^1	9.00	---		---	
Fluoride	6.52^1	0.31^1	0.30	0.38	1.60	4.50	22.00
Sodium	29.40^1	3.87^1	5.40	6.00	18.00	---	
Potassium	1.61^1	0.19^1	0.70	0.93	2.10	---	
Sulfate	151.80^1	8.60^1	14.00	24.00	145.00	183.00	530.00
Total hardness	166.63^1	16.19^1	150.00	120.00	312.00	126.00	413.00
Chloride	19.48^1	7.56^1	8.20	4.50	21.00	12.00	32.00
Iron	0.56^2	0.73^2	0.20	0.19	0.94	0.13	0.49
Mercury	(^{2,3})	(^{2,3})	( )	---		---	
Manganese	0.073^2	0.026^2	0.02	< 0.05		---	
Cadmium	(^{2,3})	(^{2,3})	(^{3})	---		---	
Cobalt	0.001^2	0.001^2	(^{3})	---		---	
Copper	(^{2,3})	(^{2,3})	(^{3})	< 0.01		---	
Lead	0.006^2	0.004^2	(^{3})	---		---	
Zinc	0.015^2	0.010^2	0.01	0.00	0.12	---	
Chromium	(^{2,3})	(^{2,3})	(^{3})	---		---	

[1] Mean of USGS data from STORET (1967-1977).
[2] Mean of data from USGS bi-monthly sampling program, 47th Report (Coffin, 1977).
[3] None detectable.
[4] All well data provided by Occidental Chemical Company.

Note: All values in mg/l unless otherwise noted.

Table 2.6-3 Annual means, Minimums and Maximums for Selected Chemical Parameters from the USGS Sampling Station in Swift Creek (Station 02315520).*

Year (Range)	Spec. Cond. µmhos/cm	pH	Alk. as $CaCO_3$ mg/l	Total P mg/l	Ortho-PO_4 mg/l	Diss.-F mg/l	SO_4 mg/l	TOC mg/l	ORG-N mg/l	NH_3-N mg/l	NO_3-N mg/l	BOD_5 mg/l
1967	318.0	6.30	18.00	---	---	3.70	100.00	---	---	---	---	---
Range	Only One Determination Made											
1968	480.0	6.25	17.50	---	23.00	6.35	120.00	---	---	---	---	---
Range	450.0-510.0	6.1-6.4	9.0-26.0	---	23.0-23.0	5.0-7.7	114-126	---	---	---	---	---
1969	347.0	6.47	46.00	---	10.87	5.18	124.50	---	---	---	---	3.00
Range	200-540.0	5.72-7.10	23.0-69.0	---	4.6-15.0	2.4-9.5	109.0-140.0	---	---	---	---	2.6-3.4
1970	424.8	5.87	6.50	---	57.17	11.95	131.50	18.00	0.72	---	---	3.64
Range	210.0-578.0	3.7-6.6	1.0-12.0	---	11.0-130.0	2.5-29.0	136.0-132.0	14.0-22.0	0.00-1.20	---	---	0.7-6.5
1971	509.3	6.47	7.00	19.50	53.83	7.38	185.00	14.00	0.51	5.10	0.87	3.64
Range	200.0-664.0	5.2-7.0	7.0-7.0	8.5-26.0	25.0-74.0	4.1-10.0	170-200	11.0-17.0	0.0-1.4	1.8-8.4	0.04-1.70	1.1-5.7
1972	438.5	5.62	5.00	12.33	20.00	8.13	160.00	15.20	0.73	2.83	2.46	3.75
Range	217.0-660.0	3.7-6.5	3.0-7.0	1.5-21.0	20.0-20.0	3.1-18.0	130.0-190.0	0.00-40.0	0.0-2.2	1.1-4.8	0.06-5.00	0.9-6.0
1973	395.2	5.84	10.00	11.38	---	4.62	124.00	16.08	0.63	3.55	1.19	3.88
Range	135.0-680.0	4.1-6.6	9.0-11.0	7.2-16.0	---	3.7-6.0	76.0-172.0	2.0-36.0	0.07-1.6	0.57-5.4	0.30-2.00	0.4-7.7
1974	563.8	5.73	2.00	26.50	---	7.88	285.00	19.83	1.00	8.18	2.35	3.42
Range	380.0-807.0	4.8-6.6	2.0-2.0	11.0-42.0	---	4.3-12.0	280.0-290.0	10.0-44.0	0.42-2.00	1.6-23.0	1.1-3.7	1.2-5.5
1975	589.5	5.95	7.67	20.50	---	6.37	170.0	17.50	1.00	6.18	2.20	6.47
Range	400.0-870.0	4.6-6.7	1.0-17.0	9.2-36.0	---	2.3-11.0	130-240	10.0-23.0	0.86-1.1	2.6-11.0	1.2-4.1	4.8-9.0
1976	465.0	6.40	11.10	21.55	---	5.20	159.00	23.42	1.92	6.25	1.71	6.36
Range	295.0-670.0	5.9-6.8	0.00-34.0	8.6-38.0	---	2.0-9.5	120.0-230.0	13.0-39.0	0.17-7.90	3.2-10.0	0.01-2.60	4.5-8.6
1977	497.6	6.49	5.50	17.71	---	5.00	110.75	23.83	0.99	7.07	1.37	4.63
Range	250.0-670.0	6.2-6.7	0.00-13.0	11.0-23.0	---	3.4-7.7	69.0-180.0	18.0-30.0	0.30-2.60	3.9-13.00	0.92-3.2	1.1-10.0
AVERAGE	456.2	6.39	12.3	18.49	32.97	6.523	151.79	18.48	.937	5.59	1.73	4.31

* Data from STORET

Table 2.6-4 Ranges of Values Obtained in the Current Sampling Program of Streams.

Parameter	STATIONS*									
	SC-1	SC-2	SCT-3	SC-4	SCT-5	SC-6	SC-7	ABC-8	SC-9	SC-9.5
Alkalinity as $CaCO_3$	2.0-94.0	11.0-95.0	3.0-11.0	14.0-100.0	8.0-18.0	6.0-106.0	28.0-105.0	30.0-99.0	0.0-106.0	0.0-109.0
BOD	<1.0-1.4	<1.0-2.4	<1.0	1.0-2.6	<1.0	1.0-2.7	1.0-2.9	1.0-2.2	<1.0	<1.0
Calcium	47.0-70.0	47.0-68.0	7.8-10.8	45.5-73.0	7.8-9.5	44.0-69.0	44.0-62.0	43.0-75.0	14.0-32.0	12.0-21.0
Chloride	14.0-21.0	7.1-17.0	1.8-19.0	12.0-16.0	9.8-13.0	12.0-25.0	13.0-16.0	12.0-19.0	12.0-16.0	8.3-16.0
Chlorophyll	37.0-52.0	43.0-58.0	0.6-1.0	61.0-71.0	0.7-1.6	67.0-73.0	75.0-82.0	120.0-130.0	3.1-9.2	4.3-45.0
Color (ALPHA units)	15-110	7-110	25-200	15-130	5-120	15-110	15-110	5-18	65-400	50-400
Conductance (μmhos/cm)	530-700	550-750	104-195	600-650	68-140	380-780	335-650	650-777	172-433	171-335
Dissolved Oxygen	4.2-9.5	4.4-9.2	7.2-12.4	3.7-17.0	6.1-13.0	4.6-18.5	2.7-12.6	1.8-16.6	8.0-12.2	4.7-11.3
DOC	13.0-39.0	13.0-42.5	6.0-29.5	12.0-29.0	4.0-21.5	12.0-29.5	12.0-29.0	8.0-20.5	10.0-42.0	32.0-48.0
Flow (cfs)	19.7-40.1	25.0-41.0	<0.1-0.8	23.6-38.5	0.2-1.1	7.3-33.1	1.6-44.0	6.3-32.7	0.0-16.9	0.0-16.1
Fluoride	4.1-7.6	4.2-8.9	0.2-0.5	4.5-9.7	0.3-0.4	4.1-12.0	3.8-7.4	3.6-12.0	0.4-1.0	0.4-0.7
Total Hardness as $CaCO_3$	183.0-290.0	184.0-290.0	8.9-37.0	2.6-292.0	27.0-34.0	95.0-243.0	174.0-288.0	171.0-345.0	63.0-129.0	55.0-136.0
Magnesium	16.0-23.0	16.0-23.0	1.6-2.3	14.9-23.0	1.8-2.2	15.1-23.0	15.6-22.0	15.3-28.0	6.8-12.0	6.1-13.0
Nitrogen										
Ammonium	3.99-20.00	4.76-18.40	0.02-0.25	0.02-20.90	0.02-0.15	1.13-20.50	8.05-22.20	8.54-40.60	0.07-0.31	0.02-0.25
Nitrite + Nitrate	1.14-4.40	1.03-4.18	0.22-0.98	1.03-3.33	0.24-1.60	0.62-3.24	0.33-3.33	0.31-3.21	0.02-0.60	0.03-0.54
Organic	0.95-1.60	0.90-1.64	0.48-0.79	1.01-2.41	0.15-0.42	0.98-2.52	0.80-3.60	1.11-2.90	0.51-2.28	0.48-2.24
Oil and Grease	<1	<1	<1	<1	<1	1-2	1-3	<1	<1	<1
pH	6.2-7.1	6.4-7.1	5.7-6.8	6.3-7.0	5.7-7.1	5.6-7.2	6.3-7.0	6.6-6.9	3.7-8.9	3.5-7.0
Phosphate as P										
Ortho	14.4-65.0	13.9-98.0	0.6-1.1	12.9-110.0	0.5-1.1	11.2-114.0	9.9-70.0	9.6-135.0	0.2-16.8	<0.1-14.5
Total	15.4-76.0	15.7-100.0	0.7-1.1	14.1-112.0	0.6-1.3	14.3-115.0	13.5-75.5	11.0-155.0	0.5-6.0	0.1-7.4
Potassium	1.6-2.0	1.6-2.0	0.7-1.0	1.6-1.9	0.2-0.7	1.6-2.0	1.6-1.9	1.6-2.6	0.2-0.4	0.4
Redox Potential(ORP)	+50-+250	+75-+260	+80-+270	-70-+280	-30-+260	+70-+290	+90-+280	-80-+260	+50-+325	+60-+350
Silica	17.0-50.0	17.4-42.0	6.9-10.4	15.8-36.0	6.8-9.8	15.1-53.0	25.6-64.0	26.8-78.0	13.7-24.0	16.0
Sodium	25.6-27.0	25.8-26.5	3.4-4.3	25.2-26.6	3.3-3.4	24.8-27.3	24.6-27.4	24.0-38.2	7.5-8.6	8.3
Solids (Dissolved)	248-768	418-794	34-120	414-716	10-118	366-764	360-736	350-882	164-236	146-242
Solids (Suspended)	4.0-14.0	1.0-16.0	1.0-14.0	2.0-26.0	1.0-18.0	1.0-38.0	1.0-29.0	1.0-63.0	6.0-122.0	6.2-103.0
Sulfate	156.0-310.0	152.0-380.0	3.9-11.0	153.0-548.0	4.0-8.6	154.0-570.0	24.0-350.0	28.3-550.0	15.3-75.0	15.0-75.0
Sulfide	<0.1-0.8	0.2-0.5	0.2-1.1	0.3-1.1	0.2-1.0	0.2-0.6	0.1-0.7	<0.1-0.6	0.4-1.1	0.4-1.5
Surfactants (MBAS)	0.001-0.045	0.013-0.051	0.011-0.062	0.018-0.05	0.010-0.034	0.008-0.041	0.024-0.034	0.022-0.051	0.008-0.025	0.002
Temperature °C	8.0-28.0	7.0-28.3	7.0-28.5	7.0-28.5	8.0-28.8	7.5-30.8	7.8-29.0	9.5-30.8	7.0-31.8	7.0-17.0
Turbidity (NTU)	1.5-8.0	0.9-7.5	0.9-1.8	0.7-8.0	0.1-1.8	1.5-10.0	1.5-20.0	1.2-42.0	1.0-32.0	1.5-42.0

* SC= Swift Creek station; SCT= Swift Creek tributary; ABC= Altman Bay Canal
Range given is based on the sampling program conducted from July 1977 to February 1978.

Table 2.6-4 (Continued)

Parameter	STATIONS*					
	SR-7	SR-8	RC-2	HC-1	RO-2	CB-1
Alkalinity as $CaCO_3$	0.0-18.0	0.0-33.0	0.0-13.0	0.0-57.0	0.0-70.0	18.0-69.0
BOD	1.0	1.0	1.0	1.0	1.0	1.0
Calcium	1.4-5.4	3.2-16.0	1.4-3.5	22.0-23.5	4.6-12.0	11.0-15.0
Chloride	6.0-8.1	6.0-8.3	6.7-8.3	7.7-11.0	5.2-11.0	6.2-12.0
Chlorophyll	0.3-0.4	1.9-9.0	0.1-0.6	1.0-56.0	0.2-1.0	0.4-3.2
Color (ALPHA units)	200-270	180-270	270-420	25-200	15-400	25-240
Conductance (µmhos/cm)	48-105	40-188	72-120	90-242	68-340	70-150
Dissolved Oxygen	7.8-12.0	7.9-13.6	6.1-11.0	4.2-18.0	3.7-13.2	7.6-11.2
DOC	26.5-45.5	32.5-39.5	43.5-73.9	10.5-73.5	4.5-36.0	10.0-49.0
Flow (cfs)	265.0	212.0-305.0	0.1-35.4	1.2-12.6	-0.1-1.7	1.0-3.4
Fluoride	0.1-0.2	0.1-1.3	< 0.1-0.1	0.1-1.1	0.2-1.1	0.3-0.4
Total Hardness as $CaCO_3$	7.0-20.0	13.0-62.0	7.7-27.0	93.0-97.0	22.0-49.0	48.0-70.0
Magnesium	0.9-1.9	1.2-5.3	1.0-3.4	9.1-9.3	2.6-4.7	5.0-7.9
Nitrogen						
Ammonium	0.02-0.35	0.08-3.96	0.02-0.34	0.02-0.56	0.02-1.15	0.02-0.21
Nitrite + Nitrate	0.01-0.04	0.01-0.50	0.01-0.02	0.04-0.82	0.06-0.60	0.01-0.97
Organic	0.49-0.72	0.52-0.94	0.38-2.03	0.22-1.68	0.06-1.65	0.11-2.20
Oil and Grease	<1	<1	<1	<1	<1	<1
pH	3.7-7.0	3.6-7.0	3.3-6.5	3.5-7.9	5.6-7.0	5.9-7.7
Phosphate as P						
Ortho	0.1-1.7	0.1-5.4	<0.1-0.1	0.2-0.8	0.4-1.4	0.3-0.6
Total	0.1-1.8	0.1-6.3	0.1-0.2	0.2-0.9	0.5-1.6	0.4-0.9
Potassium	0.2	0.5	0.2	0.6	0.6	0.2
Redox Potential (ORP)	+90-+320	+18-+380	+120-+350	+85-+360	+50-+290	+115-+230
Silica	12.0	27.0	10.0	11.0	30.0	39.0
Sodium	3.3	8.3	4.2	9.9	3.3	5.0
Solids (Dissolved)	44-98	116-201	106-144	156-182	60-128	50-140
Solids (Suspended)	0.5-18.0	1.0-8.0	1.0-8.8	2.0-9.6	1.0-14.0	5.6-76.0
Sulfate	1.9-36.0	4.0-48.0	1.0-32.0	19.0-53.0	1.0-83.0	1.0-12.0
Sulfide	0.4-1.2	0.4-0.9	0.3-3.0	0.2-1.0	0.2-0.7	0.2-1.0
Surfactants (MBAS)	0.016	0.028	0.021	0.014	0.012	0.022
Temperature °C	6.5-18.0	6.0-18.0	6.8-17.0	7.0-17.5	8.8-17.5	7.8-16.0
Turbidity (NTU)	0.9-1.8	1.0-2.5	1.0-1.8	2.1-6.8	1.0-5.0	0.8-5.8

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* SR= Suwannee River station; RC= Rocky Creek station; HC= Hunter Creek station; RO= Roaring Creek station; CB= Camps Branch station; Range given based on the sampling program conducted from July 1977 to February 1978.

River. Data on spring waters were obtained from Florida Springs (Ferguson, 1947) and through personal communications with USGS in Tallahassee, Florida. The data are presented in detail in the Resource Document.

2.6.4.3 Swift Creek

USGS has monitored Swift Creek at Facil (Station 02315520) since 1967. To determine if significant trends developed during this period, the annual means of important parameters (Table 2.6-3) were compared statistically. The analysis indicated no significant differences in concentrations of organic-nitrogen, ammonia-nitrogen, nitrate-nitrogen, total organic carbon, dissolved fluoride and orthophosphate for the period of record (Table 2.6-5). A slight increase occurred in sulfate and total phosphate as P concentrations from 1971 through mid-1977 (Tables 2.6-3 and 2.6-5). This indicates that Swift Creek has been receiving relatively constant concentrations of nutrients for a number of years and that the present aquatic system should have fully responded to the change from pre-1965 conditions.

Both USGS data and data collected during this study indicate that Swift Creek has significantly higher concentrations of phosphate as P, nitrogen, fluoride, sulfate and sodium than do other area streams (Table 2.6-4). However, concentrations of the heavy metals: cadmium, copper, lead, mercury, cobalt and zinc are low in both Swift Creek and other area streams not affected by phosphate mining and processing (Table 2.6-6).

Although the Swift Creek nutrient concentrations have been consistently higher than background levels for a number of years, no reports of problems associated with high nutrient levels in Swift Creek have been located for review. A turbidity problem existed for a period in 1975. None of the parameters discharged down Swift Creek have a potential for toxic problems at their present concentrations, with the possible exception of ammonia-nitrogen. Ammonia-nitrogen is toxic only in the unionized form which is pH and temperature dependent.

Comparisons of Tables 2.6-7 and 2.6-8 indicate that ammonia toxicity could exist under the maximum pH, temperature and ammonia-nitrogen levels. The biological indicators of water quality, however, do not indicate a toxicity stress.

Biological indicators of water quality tend to give a much better indication of long-term water quality than do grab samples for chemical analyses, since grab samples only yield information about a single point in time.

Data on the aquatic communities in Swift Creek (Section 2.7.4) indicate that organisms in Swift Creek have not been adversely impacted by the concentrations of the referenced parameters and the increased, but relatively stable, flow conditions.

Table 2.6-5 One-way analysis of variance comparing annual means for selected chemical parameters as measured by U.S.G.S.

Parameter
Period of Record — **Analysis of Variance**

Specific Conductivity
1968-1977

ANOVA

Source	SS	df	MS	F
Treatments	279429.10	9	31047.68	1.33
Error	1194840.34	51	23428.24	
Total	1474269.44	60		$P < 0.26$

Organic-N as N
1970-1977

ANOVA

Source	SS	df	MS	F
Treatments	13.09	7	1.87	1.47
Error	57.18	45	1.27	
Total	70.27	52		$P < 0.21$

NH_3-N - Total
1971-1977

ANOVA

Source	SS	df	MS	F
Treatments	132.93	6	22.16	1.64
Error	513.29	38	13.51	
Total	646.22	44		$P < 0.16$

NO_3-N
1971-1977

ANOVA

Source	SS	df	MS	F
Treatments	10.79	6	1.80	1.32
Error	50.30	37	1.36	
Total	61.08	43		$P < 0.27$

TOC
1970-1977

ANOVA

Source	SS	df	MS	F
Treatments	611.03	7	87.29	0.96
Error	3636.09	40	90.90	
Total	4247.12	47		$P < 0.47$

Fluoride - Diss.
1968-1977

ANOVA

Source	SS	df	MS	F
Treatment	275.24	9	30.58	2.04
Error	780.56	52	15.01	
Total	1055.80	61		$P < 0.53$

Ortho-P as PO_4
1968-1971

ANOVA

Source	SS	df	MS	F
Treatment	5795.11	3	1931.70	2.03
Error	12350.57	13	950.04	
Total	19145.68	16		$P < 0.19$

Total P
1971-1977

ANOVA

Source	SS	df	MS	F
Treatment	1055.40	6	175.9	2.63
Error	2745.04	41	66.95	
Total	3800.44	47		$P < 0.03$

Sulfate
1968-1977

ANOVA

Source	SS	df	MS	F
Treatment	51654.12	9	5739.35	3.27
Error	36805.75	21	1752.65	
Total	88459.87	30		$P < 0.02$

Table 2.6-6 Heavy Metal Concentrations in Surface Waters (mg/l)

Station*	Date	Arsenic mg/l	Cadmium mg/l	Chromium mg/l	Copper mg/l	Iron mg/l	Lead mg/l	Manganese mg/l	Mercury mg/l	Zinc mg/l
SC-1	July, 1977	0.011	B	B	0.004	0.156	0.002	0.050	A	0.003
	Oct., 1977	F	D	0.006	C	0.224	0.002	0.040	A	0.005
SC-2	July, 1977	D	B	B	0.002	0.104	0.005	0.050	A	0.002
	Oct., 1977	F	D	0.006	C	0.238	0.001	0.045	A	0.005
SC-3	July, 1977	D	B	B	B	0.490	0.002	0.017	A	0.004
	Oct., 1977	F	D	0.004	C	0.486	0.044	0.020	A	0.004
SC-4	July, 1977	D	B	0.003	0.002	0.436	0.002	0.070	A	0.004
	Oct., 1977	F	D	0.006	C	0.200	0.009	0.055	0.0005	0.006
SC-5	July, 1977	D	B	B	B	0.600	0.002	0.065	A	0.016
	Oct., 1977	F	D	0.004	C	0.236	0.007	0.015	0.0003	0.019
SC-6	July, 1977	0.026	B	B	0.002	0.430	0.002	0.071	A	0.004
	Oct., 1977	F	D	0.004	C	0.270	0.007	0.080	A	0.009
SC-7	July, 1977	0.031	B	B	0.002	0.216	0.001	0.060	A	0.004
	Oct., 1977	F	D	0.004	C	0.238	0.005	0.083	0.0002	0.014
ABC-1	July, 1977	0.040	B	B	B	0.184	0.002	0.050	A	0.004
	Oct., 1977	F	D	0.006	C	0.210	0.047	0.175	A	0.008
SC-9	July, 1977	0.033	B	B	B	0.324	0.001	0.015	A	0.004
	Oct., 1977	F	D	0.004	C	1.140	0.017	0.035	A	0.010
SC-9.5	July, 1977	F	D	0.006	C	1.190	0.013	0.035	0.0003	0.059
SR-7	July, 1977	F	D	0.002	C	0.398	0.007	0.020	A	0.003
SR-8	July, 1977	F	D	0.002	C	0.442	0.001	0.015	A	0.004
RC-2	July, 1977	F	D	0.002	C	0.696	0.002	0.025	A	0.005
RO-2	July, 1977	F	D	0.002	C	0.220	0.002	0.008	A	0.016
HC-1	July, 1977	F	D	0.003	C	0.174	0.005	0.015	A	0.007
CB-1	July, 1977	F	D	0.004	C	0.478	0.003	0.023	A	0.007
CB-2	July, 1977	F	D	0.003	C	0.146	0.002	0.013	A	0.016
CB-3	July, 1977	F	D	0.003	C	0.133	0.014	0.006	A	0.007

* See Figure 2.3.3 for location of sampling stations.

Detection Limit: A, B, C, D, E, and F represent 0.0002, 0.002, 0.004, 0.006, 0.008 and 0.020 mg/l, respectively.

Table 2.6-7 Concentrations of total ammonia (NH_3 + NH_4+) which contain an un-ionized ammonia concentration of 0.020 mg/l NH_3*.

Temperature (°C)	pH Value								
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	160.0	51	16.0	5.1	1.6	0.53	0.18	0.071	0.036
10	110.0	34	11.0	3.4	1.1	0.36	0.13	0.054	0.031
15	73.0	23	7.3	2.3	0.75	0.25	0.093	0.043	0.027
20	50.0	16	5.1	1.6	0.52	0.18	0.070	0.036	0.025
25	35.0	11	3.5	1.1	0.37	0.13	0.055	0.031	0.024
30	25.0	7.9	2.5	0.81	0.27	0.099	0.045	0.028	0.022

Table 2.6-8 Conditions in Swift Creek necessary to determine NH_3 levels.

Date	Ammonia	pH	Temperature[1]
12-7-71	8.4	6.8	15[2]
2-7-73	5.4	6.3	15
6-5-73	5.3	5.8	24
2-12-74	23.0	6.4	15
4-3-74	7.2	5.5	20
6-11-74	9.0	4.8	26
10-8-74	6.2	5.7	25
9-29-75	10.0	6.7	25
12-8-75	11.0	6.3	14
2-2-76	6.5	6.3	14
4-5-76	7.4	6.7	21
5-3-76	6.0	6.5	23
5-21-76	9.1	6.6	23
8-30-76	5.0	6.7	26
10-4-76	8.4	6.4	22
11-1-76	10.0	6.8	18
11-30-76	5.6	6.5	18
1-31-77	6.1	6.5	15[2]
2-28-77	5.1	6.7	15[2]
4-13-77	6.9	6.7	20[2]
6-6-77	6.3	6.5	25[2]
8-1-77	8.2	6.3	25[2]
10-3-77	13.0	6.5	23[2]

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[1] Based on monthly averages.

[2] Estimated from previous years.

Table 2.6-9 Mass loadings under average flow of selected parameters for Swift Creek and downstream Suwannee River stations. (All values in kg/day).

Station	Total Phosphorous (P)	Total Nitrogen (N)	Total Organic Carbon (TOC)	Sulfate (SO_4)	Fluoride (F)
Suwannee River at White Springs (USGS #02315500)	428	3,676	148,000	20,400	912
Swift Creek at mouth	2,300	1,019	2,760	21,700	766
Suwannee Springs (USGS #02315550)	2,850	4,515	139,000	50,800	1,900
Alapaha River near Statenville	261	*	39,500	4,490	398
Withlacoochee River at mouth	639	3,528	67,400	22,400	1,380
Suwannee River at Branford (USGS #02320500)	3,340	10,633	212,000	147,000	3,920
Sante Fe River at Ft. White	317	*	*	82,900	*
Suwannee River at Wilcox (USGS #02323500)	3,830	14,530	269,000	295,000	5,770

* Insufficient data

Table 2.6-10 Mass loadings under low flow (M7,10) of selected parameters for Swift Creek and downstream Suwannee River stations. (All values in kg/day).

Station	Total Phosphorous (P)	Total Nitogen (N)	Total Organic Carbon (TOC)	Sulfate (SO_4)	Fluoride (F)
Suwannee River at White Springs (USGS #02315500)	9.33	23	460	257	6.6
Swift Creek at mouth	1,050	485	917	11,000	347
Suwannee Springs (USGS #02315550)	618	499	2,330	4,080	98
Alapaha River near Statenville	25	*	363	136	15
Withlacoochee River at mouth	78	244	2,590	6,570	133
Suwannee River at Branford (USGS #02320500)	1,110	5,450	22,100	93,100	848
Sante Fe River at Ft. White	139	*	*	62,600	327
Suwannee River at Wilcox (USGS #02323500)	1,370	13,455	52,500	273,000	2,170

* Insufficient data

Macroinvertebrates and periphyton, which are often used as indicators of water quality, and fish were not significantly stressed by the higher concentrations of phosphate, nitrogen, fluoride and sulfate (Section 2.7.4 of the Resource Document).

No significant differences were detected ($P<0.05$) between diversity indices for fish populations in Swift Creek and those in streams which represent a natural state with no mining influences. Periphyton and macroinvertebrate diversity and equitability indices were both above the levels indicating stress (EPA, 1973) and were not significantly different ($P<0.05$) from indices for natural streams (Section 2.7.4 of the Resource Document).

The biological indicators of water quality do not indicate any significant stress or degradation in Swift Creek water quality, even though concentrations of nutrients, sulfate and fluoride are higher than concentrations in natural streams.

2.6.4.4 Influence of Swift Creek and Other Major Tributaries on the Suwannee River

Swift Creek discharges into the Suwannee River just below White Springs. Mass loadings for important parameters were calculated based on flows and chemical parameters measured at USGS stations on Swift Creek, the Suwannee River and its major tributaries (Figure 2.6-2). The discharge of chemical parameters into the Suwannee River were calculated on a mass basis for phosphate, total nitrogen, total phosphate, dissolved fluoride and sulfate under average flow (Table 2.6-9) and low flow (M7, 10) conditions (Table 2.6-10). These values were used to assess the contribution of nutrients to the Suwannee River from Swift Creek and other major tributaries. The calculated percentages should be considered the maximum possible contributions because some of the nutrients entering the Suwannee River from Swift Creek may be lost or tied up in biomass by the time the water reaches Suwannee Springs. According to reports by Cox (1971) and Ferguson (1947), numerous springs begin discharging into the Suwannee after it passes White Springs, some with flows as high as 55 cfs, which is equivalent to the flow in Swift Creek. These springs add varying amounts of sulfate, phosphate and fluoride. A typical analyses of spring water is given in Table 2.6-2.

Based on calculations from available data, the following conclusions were drawn. Swift Creek could contribute up to a maximum of 81 percent of the phosphate, 40 percent of the fluoride, 43 percent of the sulfate and 23 percent of the total nitrogen measured under average flow conditions at Suwannee Springs USGS Station 02315550 on the Suwannee River. The percentage contributions from Swift Creek drop to a maximum of 73 percent of the phosphorus, 13 percent of the fluoride, 7 percent of the sulfate and 7 percent of the total nitrogen measured in the Suwannee at USGS

Wilcox Station 02323500. These relatively high percentage increases should not be misinterpreted. While a mass balance allows determinations of the relative importance of the various sources and sinks of materials in a system, the actual impact is a function of concentration. The concentrations at the respective stations are 1.11 mg/l P, 0.21 mg/l P and 0.17 mg/l P at Suwannee Springs, Branford and Wilcox, respectively.

Under low flow (M7, 10) conditions, determinations of Swift Creek contributions are unreliable for total phosphate as P, sulfate and flouride, since the mass at Suwannee Springs is below the amount computed to be added by Swift Creek.

Possible explanations for this apparent decrease are: (1) that the estimated discharge from Occidental is too high for the periods of low flow; or (2) a portion of the phosphate as P, sulfate and fluoride may be present as suspended particles which could settle out in the Suwannee due to its slower velocity at low flow.

Swift Creek contributes the majority of the phosphate as P contained in the Suwannee River. It contributes from 4 to 9 times the amount added by the other major tributaries. Swift Creek was shown to have natural high levels (1.6 mg/l P) even before Occidental began mining in the area (FSBH, 1966). The present concentration in Swift Creek is 18.5 mg/l P. While the majority of the phosphates appears to enter the Suwannee from Swift Creek, this does not appear to be the case for other parameters measured under average flow conditions.

Three times as much nitrogen enters the Suwannee River from the Withlacoochee as from Swift Creek (Table 2.6-9). Although insufficient data were available to make calculations for the Alapaha and Santa Fe Rivers, they probably add similar amounts. Run-off from agricultural lands and forests is a contributing factor in the nitrogen content of these tributaries.

Swift Creek adds relatively small amounts of total organic carbon to the Suwannee River. The Alapaha and Withlacoochee Rivers both add 15 to 20 times the Swift Creek mass contribution of total organic carbon (Table 2.6-9). Runoff from forest and drainage from swamps probably also adds high amounts during periods of run-off.

The Withlacoochee, Alapaha and Santa Fe Rivers' sulfate mass contribution are 103 percent, 21 percent and 380 percent, respectively of the Swift Creek contribution (Table 2.6-9). This probably reflects the relative amounts of groundwater they receive, since sulfate is relatively high in groundwater. The high sulfate concentrations in Swift Creek result from groundwater (Table 2.6-2) and from that picked up in the nonprocess water due to plant activities.

Fluoride concentrations in the Suwannee River are below both the FDER 10 mg/l maximum for Class III waters and the 1.6 mg/l maximum for Class I potable waters. Major contributors of fluoride to the Suwannee at average flow are Swift Creek (766 kg/day), the Alapaha River (398 kg/day), and the Withlacoochee River (1380 kg/day). The Santa Fe is also probably a major contributor; however, there were insufficient data to project a fluoride loading (Table 2.6-9).

A study is underway to assess the effect of fluoride on aquatic and terrestrial organisms in Swift Creek and the Suwannee River. It is anticipated that data will be included in the final EIS documents.

2.6.4.5 Summary

2.6.4.5.1 Swift Creek

Swift Creek has high concentrations of sulfate, phosphate, and fluoride when compared to other area streams. It is strongly influenced by the discharge from Occidental Chemical Company.

Biological indicators of water quality which give a long-term assessment of conditions in streams indicate no severe stress to the aquatic system in Swift Creek. Community diversity and biomass are not significantly different from other area streams.

2.6.4.5.2 Suwannee River

Based on mass loadings calculated for average flow conditions in each of the major tributaries of the Suwannee, Swift Creek contributes the majority of phosphate to the Suwannee, while the Withlacoochee contributes the majority of the total nitrogen, total organic carbon and fluoride. The Santa Fe River contributes the majority of sulfates to the Suwannee.

Since nitrogen and phosphate concentrations in the Suwannee River are high and there have been no indicators of nutrient related problems, other nutrients or physical factors must be limiting to aquatic plants in the river. The mixing due to the relatively high velocity of the river and its highly colored water which limits light penetration are probably major limiting factors preventing utilization of the available nutrients.

After Occidental began mining operations in 1965 and water quality stabilized, based on a report by Coffin (Coffin, 1977), significant water quality changes have not occurred since 1967.

2.6.5 GROUNDWATER QUALITY

2.6.5.1 Sampling Program

Several analyses for major and minor chemical constituents were performed on samples from four series of observation wells located around the proposed Swift Creek site (Figure 2.3-1). Three to five wells of varying depth ranging from 10 to 300 feet were drilled in each set. In addition, several existing water supply wells at the Swift Creek Beneficiation Plant were analyzed for chemical composition.

2.6.5.2 Water Quality in Surficial Aquifer and Hawthorn Formation

Water quality results are presented in the Resource Document.*

In general, the surficial aquifer has acidic water (pH between 4.5 and 6.5). A trend of increasing pH with depth is evident; pH ranged from about 6 to 7.5 in the phosphate matrix layer, and above 7.0 at greater depths. Specific conductance levels were generally low (60-200 μmho/cm) in the surface wells and were higher in the Hawthorn Formation (200-400 μmho/cm).

Fluoride levels ranged between 0.12 and 1.8 mg/l in all the well analyses, but only 4 of 46 measurements were above 1 mg/l. There were no significant trends with depth.

Total hardness generally increased from the shallow wells to the wells in the Hawthorn Formation; but within the latter formation, concentrations were variable with no trends over depth. The surficial wells had very low levels of alkalinity. With one exception, chloride levels were low (3-9 mg/l) in all wells. Sulfate levels were rather consistent with depth and seldom above 10 mg/l.

Orthophosphate concentrations ranged from less than 0.1 mg/l P to about 3.0 mg/l P in the surficial aquifer. The matrix zone had generally higher but rather variable concentrations (0.13 to 9.2 mg/l P). Deeper in the Hawthorn Formation, orthophosphate ranged up to about 3.2 mg/l P. Nitrate levels were very low (<0.1 mg/l N at all sites and depths. Ammonium concentrations tended to increase with depth. Concentrations were generally less than 1.0 mg/l N, and most results were less than 0.5 mg/l. The surficial aquifer had concentrations ranging from <0.02 to 0.20 mg/l N.

Color is essentially absent in the deeper wells, but the surficial aquifer had up to 180 Pt units. Iron concentrations were high (0.9 to 7.5 mg/l) in the surficial aquifer and in all cases exceed the recommended maximum (0.3 mg/l) for drinking water. In the phosphate matrix and the lower part of the Hawthorn Formation, iron values were somewhat lower (0.2 to 5.2 mg/l) but still exceeded the drinking water standard. Manganese levels were lower, and most samples were within the recommended drinking water standard. Other heavy metals had low to undetectable levels in all wells.

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* Section 2.9 discusses the radio-chemical data.

In summary, groundwater quality in the surficial and Hawthorn layers at the Swift Creek site is rather variable over depth and time. The water is soft, acidic, somewhat colored, and high in iron in the surficial aquifer; the Hawthorn Formation has generally hard water with neutral to alkaline pH. Levels of phosphate are relatively high in this zone, as expected from the geochemistry of the region. Iron is also high throughout the Hawthorn formation and frequently exceeds drinking water standards. Heavy metal pollution is absent and concentrations of other major ions are in the typical range for waters of the Hawthorn Formation.

2.6.5.3 Water Quality in Floridan Aquifer

Groundwater quality in Occidental supply wells tapping the Floridan Aquifer is in general agreement with the regional data (Meyer, 1962; Miller, et al., 1977). The Floridan Aquifer water in wells at the Swift Creek site and in other wells in the area is characterized by a pH generally between 7.0 and 8.0, total hardness ranging from 120 to 350 ppm as $CaCO_3$, and dissolved solids less than 500 mg/l. Occidental supply wells had (at the Swift Creek Beneficiation Plant) orthophosphate levels ranging from 0.08 to 0.36 mg/l P. Concentrations of iron ranged from 0.06 to 1.1 mg/l, and about half the values are above the drinking water standard. All but one manganese analysis were below the drinking water standard of 0.05 mg/l. Heavy metals are low to undetectable.

At great depths, the Floridan Aquifer contains more mineralized water. The thickness of the potable water zone is estimated to range from 1000 to 2000 feet (Klein, 1975).

2.6.6 WATER USES AND ISSUES

2.6.6.1 Water Supply

The proposed Swift Creek Chemical Complex lies in Hamilton County, Florida, within the jurisdiction of the Suwannee River Water Management District.

Direct surface water withdrawals comprise only a small part of the source of water supply in Hamilton County. By far, the principal source of water for industrial, municipal, agricultural and domestic uses in Hamilton County and in the Suwannee River Water Management District comes from groundwater. Three aquifers exist in the District: (1) the "surficial aquifer," (2) the "secondary artesian aquifer," and (3) the "Floridan aquifer."

The surficial and secondary artesian aquifers are sources of water supply for small domestic, stock and some agricultural uses. The Floridan Aquifer is the principal source of groundwater in Hamilton County as well as in the district as a whole.

2.6.6.2 Water Uses

Water uses in the three-county area of Columbia, Hamilton and Suwannee are summarized in Table 2.6-11. Municipal supply systems use only groundwater as a source and include incorporated cities and towns as well as unincorporated small communities having a central supply system. All other residents are counted as rural domestic users. These users also pump groundwater as the only source of domestic supply at an estimated rate of 100 gallons per day per person (SRWMD, 1977). Livestock water consumption which uses both surface and groundwater sources is included in the rural water use category.

The main industrial user of groundwater in the three-county area is Occidental Chemical Company whose groundwater withdrawals consist of approximately 30 MGD. Occidental also recycles approximately 305 MGD of water within their hydraulic systems. Occidental does not withdraw any water directly from surface streams or natural lakes. Evaporation losses in the settling ponds are more than replenished by precipitation.

The main user of surface water in the three-county area is a thermoelectric power plant in Suwannee County. Its usage includes approximately 172 MGD of surface water withdrawn then returned to the source, heated to some extent, but otherwise unaltered in quality.

Table 2.6-11

WATER USE IN 1975 IN THE THREE-COUNTY AREA
(COLUMBIA, HAMILTON, AND SUWANNEE)
(All Values in Millions of Gallons per Day - MGD)

GW = Groundwater
SW = Surface Water

County	Municipal		Rural		Irrigation		Thermo-Electric and Industrial	
	GW	SW	GW	SW	GW	SW	GW	SW
Columbia	1.68	0	1.60	0.17	10.75	1.19	1.12	0
Hamilton	0.60	0	0.69	0.07	1.34	0.15	30.30	0[1]
Suwannee	1.12	0	1.52	0.02	1.42	0	2.40	173.73[2]
TOTAL	3.40	0	3.81	0.26	13.51	1.34	33.82	173.73[1,2]
	3.40		4.07		14.85		207.55[1,2]	

TOTAL USE = 229.87 MGD[1,2]

[1] 305 MGD of water wholly recycled within the hydraulic systems of the phosphate industry is not included in these data.

[2] 172 MGD of water used in conjunction with thermo-electric power is returned to the Suwannee River.

Data from Leach (1977)

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2.7 BIOLOGY AND ECOLOGY

2.7.1 AREA ECOSYSTEM MODIFIERS

Forestry management, agriculture and phosphate mining and processing are the major area ecosystem modifiers. Urbanized areas are relatively small and limited to Jasper and White Springs. Agriculture is confined to the well-drained strip of soil along the Suwannee River. Long-term management for pine production has modified the surrounding natural flatwoods association (Figure 2.7-1). Phosphate mining and processing has occurred in the area since the mid-1960's. Discharge from mining and processing operations is via Swift Creek and Hunter Creek into the Suwannee River from the existing Suwannee River Mine and Chemical Complex. The discharge quality of the Swift Creek Chemical Complex will be similar to that of the Suwannee River Complex and will be discharged into Swift Creek.

2.7.2 AQUATIC COMMUNITY

2.7.2.1 Swift Creek

The discharge to Swift Creek is composed primarily of waters released through Altman Bay Lake (EPA 001-7),* from the Suwannee River Mine; and out of the SRCC retention pond (EPA 001-2);* and from the Swift Creek Mine. These are clear, relatively high nutrient waters, and the stable base flow which they provide has probably modified the original natural community composition. Aquatic macrophytes are uncommon due to shading. Limited flooding has opened the canopy near the creek mid-section allowing several marsh vegetation species to become established.

The plankton dominated systems of Altman Bay Lake and the retention pond discharge provide a plankton input to the creek which is atypical of area streams. The mean diversity of the replicated Swift Creek stations (Table 2.7-1) indicates a relatively diverse periphyton community and low stress conditions. Of the sampled Swift Creek stations, 88 percent had a higher diversity than the mean diversity of streams not influenced by mining. Equitability values of Swift Creek stations were about 0.5 or greater ($\overline{x} = 0.64$). The mean equitability of nearby streams sampled was 0.52. The means were not significantly different ($p \leq 0.05$).

The addition of plankton to Swift Creek from Altman Bay Lake has resulted in a more diverse plankton community which provides a richer trophic base upon which higher trophic levels can feed. This gives Swift Creek the potential for a more diverse and stable aquatic community.

Macroinvertebrates were sampled from natural substrates for baseline conditions and with artificial substrates to compensate for substrate variability and to provide an indication of water quality conditions.

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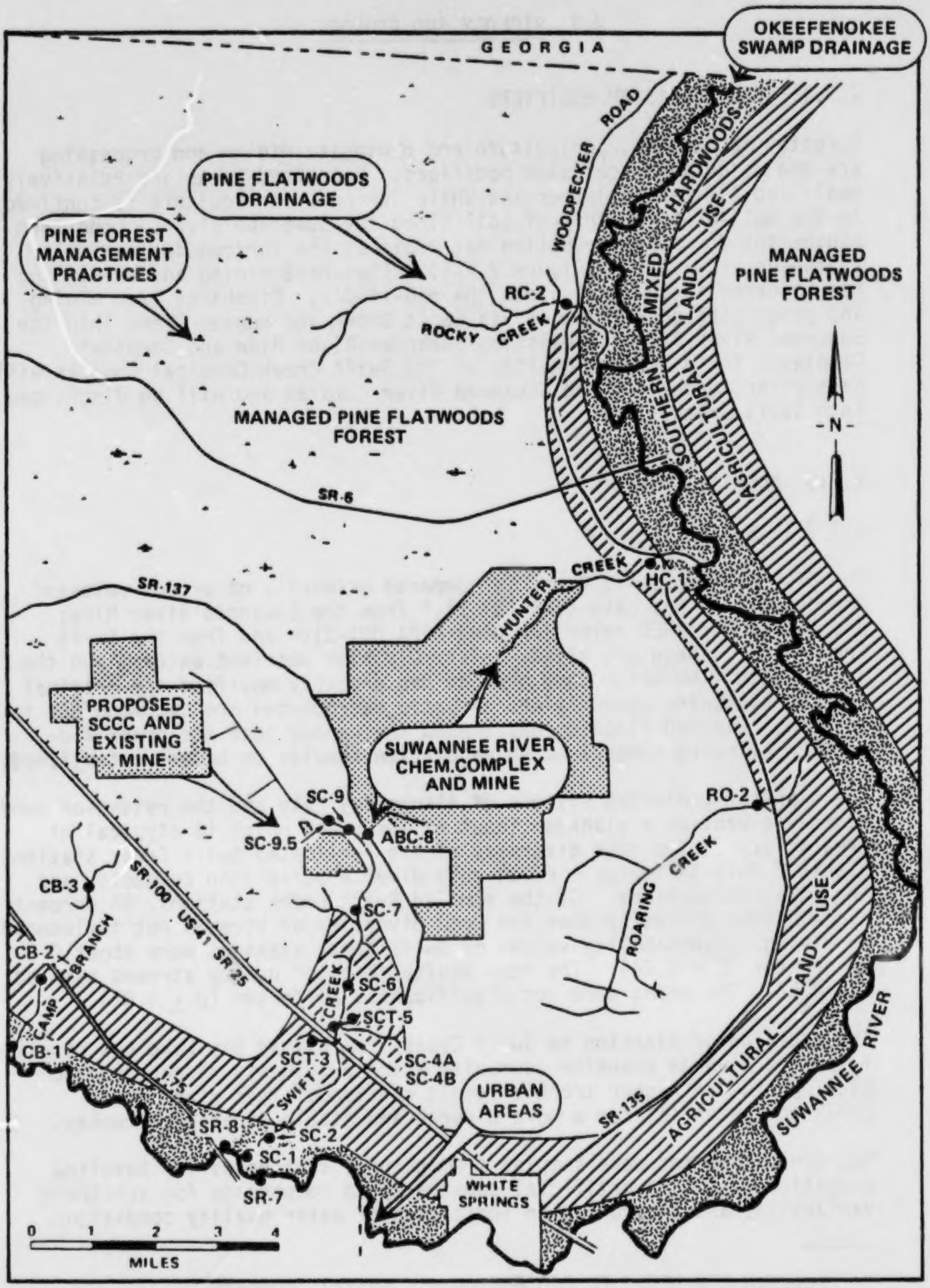
* Proposed EPA NPDES FL 0000655 permit outfall numbers


GEORGIA
OKEEFENOKEE SWAMP DRAINAGE
WOODPECKER ROAD
PINE FLATWOODS DRAINAGE
PINE FOREST MANAGEMENT PRACTICES
MIXED HARDWOODS
SOUTHERN
AGRICULTURAL LAND USE
MANAGED PINE FLATWOODS FOREST
RC-2
ROCKY CREEK
N
MANAGED PINE FLATWOODS FOREST
SR-6
SR-137
HUNTER CREEK
HC-1
PROPOSED SCCC AND EXISTING MINE
SUWANNEE RIVER CHEM.COMPLEX AND MINE
SC-9
SC-9.5
ABC-8
RO-2
ROARING CREEK
CB-3
SR-100
US-41
SR-25
SC-7
CB-2
CAMP BRANCH
SC-6
SWIFT CREEK
SCT-5
CB-1
SCT-3
SC-4A
SC-4B
I-75
URBAN AREAS
SR-135
AGRICULTURAL LAND USE
SUWANNEE RIVER
SR-8
SC-2
SC-1
SR-7
WHITE SPRINGS
0
1
2
3
4
MILES

MAJOR FORCING FUNCTIONS AND COMPONENTS OF THE OCCIDENTAL AREA ECOSYSTEM AND SAMPLING STATIONS

FIGURE 2.7-1

Table 2.7-1 Periphyton community indices for Swift Creek and nearby streams.

	Swift Creek Station Numbers							
Parameter	SC-1	SC-2	SC-4A	SC-4B	SC-6	SC-7	SC-9	Average
No. of Taxa	16	23	20	17	21	16	9	18.7
Diversity	3.25	2.98	3.39	3.25	2.80	2.66	1.88	2.99
Equitability	0.88	0.48	0.75	0.82	0.48	0.55	0.53	0.64

	Nearby Streams Station Numbers					
	Hunter Creek	Roaring Creek	Rocky Creek	Suwannee River	Suwannee River	Av.
No. of Taxa	9	13	12	18	19	14.2
Diversity	1.18	1.93	2.95	2.42	3.01	2.30
Equitability	0.31	0.38	0.92	0.42	0.58	0.52

Table 2.7-2 Results of Sediment Sampling for Macroinvertebrates in Study Area Streams

Station	Number of Taxa	Number of Individuals	Mean Diversity	Mean Equitibility	I	II	III	IV	V	Beck's Biotic Index
SC-1	7	73	1.90	0.75	1	3	2	-	1	5
SC-2	6	88	0.56	0.36	1	2	3	-	-	4
SCT-3	14	90	3.07	0.88	3	5	3	-	3	11
SC-4A	15	521	2.89	0.70	5	5	3	-	2	
SC-4B	18	465	2.93	0.62	5	6	5	-	2	16
SCT-5	24	432	3.16	0.53	6	9	5	1	3	21
SC-6	18	145	3.26	0.80	3	5	7	-	3	11
SC-7	12	1892	1.21	0.27	2	2	6	-	2	6
ABC-8	3	1633	0.73	0.70	-	-	3	-	-	0
SC-9	16	163	2.60	0.59	2	4	7	-	3	8
SC-9.5	15	378	2.69	0.66	2	5	4	-	4	9
CB-1	8	27	2.38	0.91	-	2	3	-	3	2
CB-2	13	118	3.02	0.89	1	4	4	-	4	6
CB-3	12	62	2.16	0.54	3	3	3	-	3	9
RC-2	20	74	3.06	0.66	6	7	3	-	4	19
HC-1	16	90	3.22	0.82	2	5	5	1	3	9
RO-2	19	139	3.28	0.86	4	7	4	-	4	15
SR-7	12	71	2.47	0.75	2	5	2	-	3	9
SR-8	11	69	2.64	0.80	4	3	2	-	2	11
CB-x̄	11	69	2.52	0.74	1	3	3	-	4	5
SC-x̄	12	595	2.09	0.61	2	4	4	-	2	8
Natural Stream x̄	17	94	2.95	0.75	4	6	3	-	4	14

Table 2.7-3 Results of Hester Dendy Sampling for Macroinvertebrates in Study Area Streams

Station	Number of Taxa	Number of Individuals	Mean Diversity	Mean Equitibility	I	II	III	IV	V	Beck's Biotic Index
SC-2	8	63	2.04	0.77	3	3	1	-	1	9
SC-4A	8	264	1.84	0.58	2	4	1	-	1	8
SC-4B	10	111	2.36	0.71	2	4	2	-	2	8
SC-6	11	103	2.60	0.78	3	4	3	-	2	10
SC-7	8	76	1.92	0.61	2	2	3	-	1	6
ABC-8	5	303	1.19	0.57	-	2	3	-	-	2
SC-9	7	27	1.84	0.72	2	2	1	-	2	6
CB-1	6	15	2.34	1.17	2	2	-	1	1	6
CB-2	6	17	2.25	1.14	3	2	1	-	-	8
CB-3	5	9	2.23	1.18	3	1	-	-	1	6
RC-2	5	12	1.70	0.93	3	1	-	-	-	7
HC-1	9	42	2.44	0.88	4	3	-	-	2	11
RO-2	10	68	2.50	0.73	3	4	1	-	2	10
SR-7	7	74	2.14	0.72	4	3	-	-	-	11
SR-8	8	77	2.00	0.74	4	2	1	-	1	10
CB-x̄	6	14	2.27	1.16	2	2	-	-	1	6
SC-x̄	8	135	1.94	0.71	2	3	2	-	1	7
Natural Stream x̄	7	31	2.16	0.96	3	3	-	-	1	9

To compare the aquatic community well being several indices of water quality in the streams and community structure were calculated. Beck's Biotic Index ranged from a low of 3.7 at SC-2 to a high of 15.7 at SC-4B for natural substrate collections (Tables 2.7-2 and 2.7-3). The mean of both sampling periods, 7.5, is well above the level generally thought indicative of pollution (Beck, 1954, 1955). Artificial substrate values ranged from 4.0 to 10.3 with a mean of 7.3 for both sampling periods. No clear trends are evident except for a possible increase in the index downstream. This would be expected since the samplers have a better chance of collecting colonizer organisms downstream due to a greater volume of water flow past them.

Means of Beck's Biotic Index for control streams were compared to means of the Swift Creek stations and no significant differences were detected ($P<0.05$) (Table 2.7-4) which indicates that the aquatic communities in Swift Creek are unstressed.

Diversity ranged from 1.02 to 2.60 for artificial samplers in Swift Creek over the fall and winter sampling periods. The mean, 1.80 during these periods, indicates that Swift Creek could be under moderate stress (Figure 2.7-2). However, indices calculated from natural substrate collections averaged 2.05 which indicates light to moderate stress (Figure 2.7-3). The average Swift Creek values were compared with the means of control (i.e. nonphosphate influenced) streams and no significant differences ($P\leq0.05$) could be detected (Table 2.7-4). This tends to suggest that the lower diversity values could be due to natural conditions in the study area and not from Occidental mining and processing influences. Streams in the area are typically brown water streams which are characteristically heterotrophic and relatively less productive than streams which are autotrophic and do not have darkly stained, humic, swamp waters which limits light penetration and subsequently production.

Average equitability values from sediment collections along Swift Creek were 0.59 in the fall and 0.69 in the winter. Station e values from the artifical substrates averaged 0.72 in the fall and 1.06 in the winter.

All artificial substrate collections from Swift Creek had equitability values above 0.58 for both sampling sessions. Station equitability values from natural substrate collections were below 0.5 at SC-2 ($e=0.36$) and SC-7 ($e=0.27$) during the fall and at SC-4 ($e=0.48$) and SC-9 ($e=0.42$) during the winter. These lower values probably indicate substrate limitations rather than water quality limitations since artificial substrate samplers at the same stations showed equitability values well above the 0.5 break point value for unstressed conditions (Figure 2.7-2).

Only one significant difference ($P<0.05$) was detected between Swift Creek and the natural streams used as controls (Table 2.7-4). The difference occurred between artificial substrate collections during the fall sampling. Even though a difference was detected, both means were well above the breakpoint value between stressed and unstressed communities. In fact, all means indicated a relatively unstressed condition (Figures 2.7-2, 2.7-3).

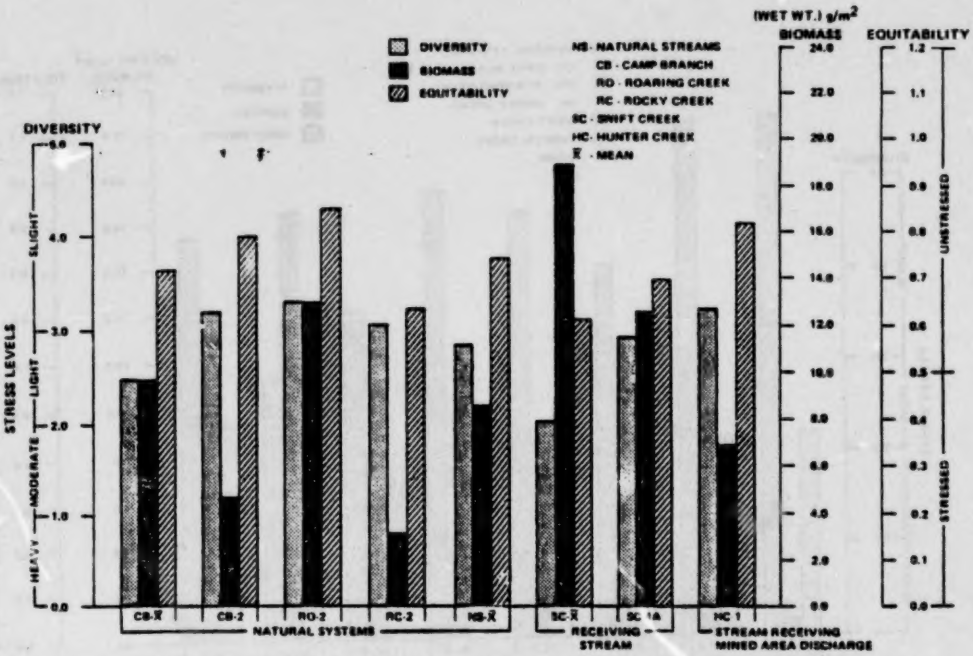
A one way analysis of variance was used to compare the mean biomass from Swift Creek main channel stations with the mean of the various control stations. Although the artificial substrate biomass estimates from the Swift Creek stations (0.79 g/m^2) averaged higher than the control stations (0.17 g/m^2), the difference was not significant (α = .05). Station biomass averages from the natural sediment collections were about the same for Swift Creek main channel stations (1.14 g/m^2) and the control stations (1.18 g/m^2).

The fish community differences of Swift Creek compared to the nearby streams is indicative of natural ecological differences and not deleterious environmental changes (C. Gilbert, Florida State Museum, written communication). Differences were detected in mean diversity values of Swift Creek versus nearby streams (Table 2.7-6). However, this included Swift Creek stations which were not representative of the physical setting sampled at the nearby streams. Comparison of a representative Swift Creek Station (SC-4) with three of the four nearby streams failed to show a significant difference (Table 2.7-6). No significant differences were detected in mean biomass of Swift Creek stations and nearby streams nor the representative Swift Creek Station (SC-4) and nearby streams (Table 2.7-7).

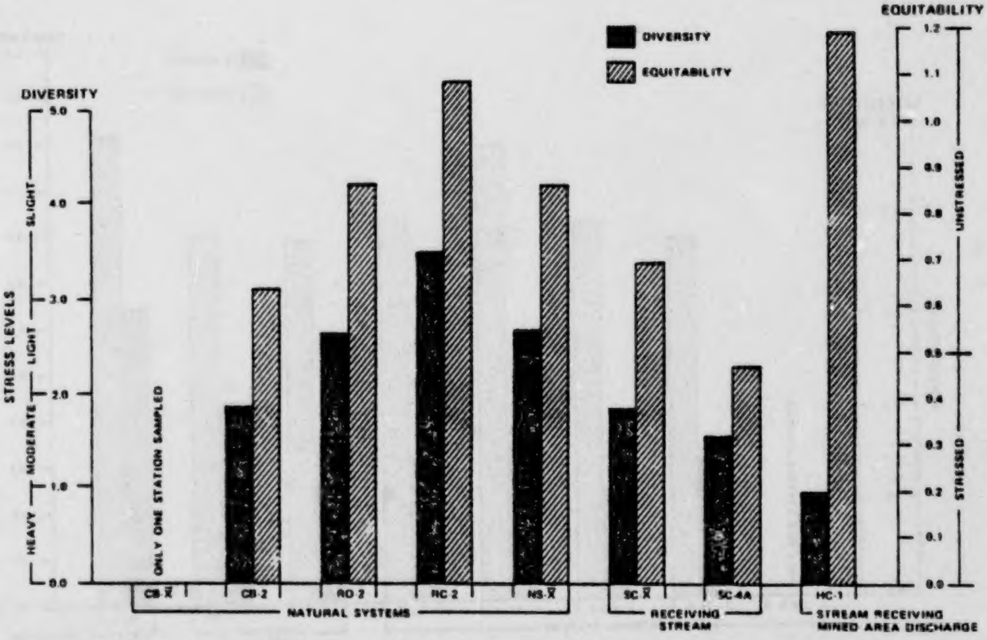
2.7.3 TERRESTRIAL COMMUNITIES OF SWIFT CREEK

Swift Creek Swamp lies north and east of the proposed SCCC. It is a disturbed hardwood swamp, dominated by broad-leaved deciduous tress which include blackgrum, cypress, pop ash, red maple, and water oak. Subdominate flora includes Florida elm, wax myrtle, button bush, and swamp bay. The ground cover is sparse and composed primarily of seedlings, ferns, lizards tail, and sphagnum. Mixed hardwood swamps account for approximately 7,036 acres in the five-mile radius study area of which Swift Creek Swamp occupies approximately 50 percent of this acreage. The northwest half of the drainage for the Swift Creek watershed is dominated by this swamp. The natural outlet is at the north of the swamp at the northwest corner of Section 10, T1S, R15E. Recent modifications include a low berm across the southern edge of the swamp (Sections 3 and 4, T1S, R15E) which effectively separates Swift Creek Swamp and Swift Creek and therefore modifies flood flows from the swamp. Previous modifications to the swamp from the timber industry included channelization for drainage and subsequent timber harvesting. These and other changes have resulted in a disturbed swamp system. However, construction of the SCCC will not further disturb Swift Creek Swamp.

Vegetation of the upper portions of Swift Creek consists of pine flatwoods and pine plantations interspersed with cypress domes, bayheads, and mixed hardwoods swamps. Streamside communities of the upper portions are characterized for the most part by species primarily associated with prolonged seasonal flooding. Mesic and hydric phases of southern mixed hardwoods are the most prevalant vegetative components of the mid-creek region. Tree stress is prevalant in this area. The stress area is approximately 3 miles long and averages 100-150 yards in width. It has been noted that mature individuals of

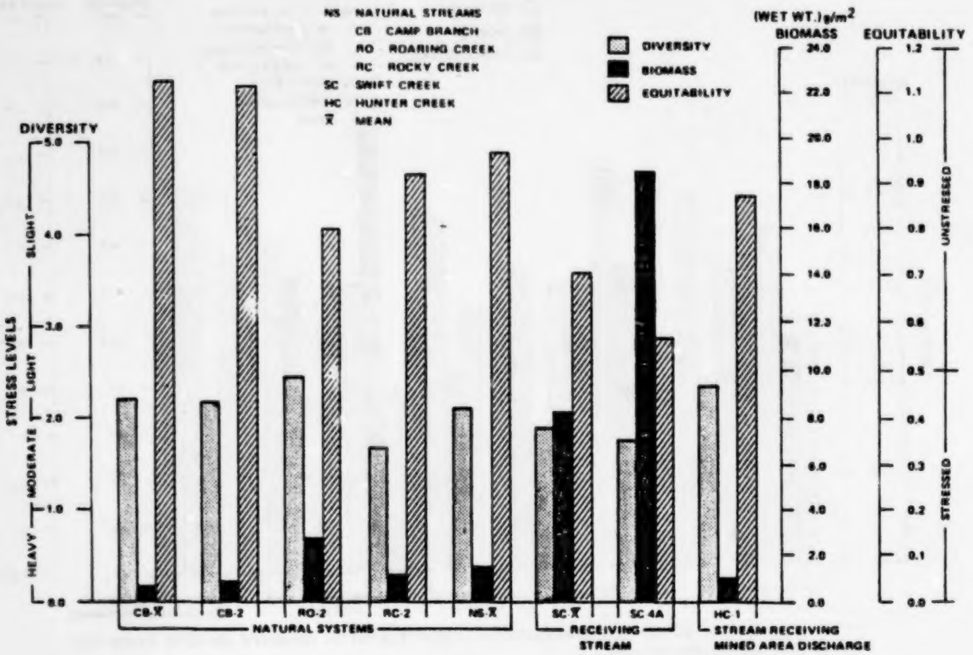


BENTHIC NATURAL SUBSTRATE MACROINVERTEBRATE SYSTEM QUALITY INDICES FROM THE FALL, 1977 SAMPLING PERIOD

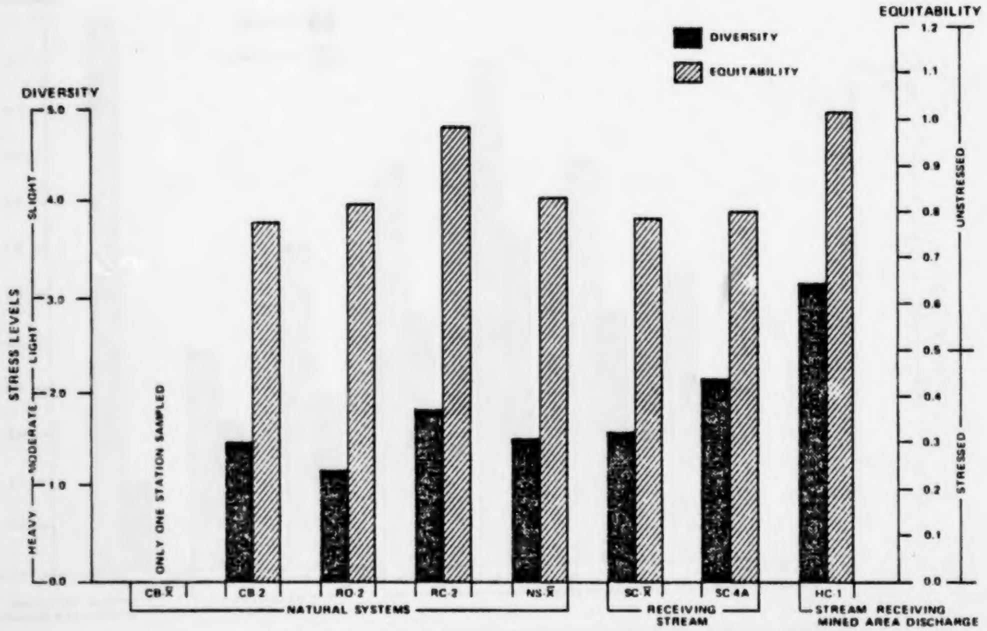


BENTHIC NATURAL SUBSTRATE MACROINVERTEBRATE SYSTEM QUALITY INDICES FROM THE WINTER, 1978 SAMPLING PERIOD

FIGURE 2.7-2



ARTIFICIAL SUBSTRATE MACROINVERTEBRATE SYSTEM QUALITY INDICES FROM THE FALL, 1977 SAMPLING PERIOD



ARTIFICIAL SUBSTRATE MACROINVERTEBRATE SYSTEM QUALITY INDICES FROM THE WINTER, 1978 SAMPLING PERIOD

FIGURE 2.7-3

both water tolerant and intolerant species have been killed or stressed. Chronic flooding is probably the primary cause for stress and/or kill of those species. Mesic and xeric phases of southern mixed hardwoods occupy the lower creek region with mature stands being quite common, although some cutting has occurred.

Of the 51 species of mammals which could occur within the study areas, 28 (55 percent) were confirmed within the Swift Creek watershed, 14 (27 percent) on the Swift Creek Mine site, and 21 (41 percent) on the Suwannee River Mine site.

Trapping of small mammals in natural communities along Swift Creek and on the two mine areas revealed a greater trap success and number of individuals (abundance) on mined lands than on natural communities (Table 2.7-8). For example, the Suwannee River complex mined lands had a trap success approximately five times greater than the Swift Creek natural communities.

The number of different species was the same among all three areas; however, species composition was somewhat different. The most obvious difference of the mammalian fauna of the Swift Creek natural communities and mined areas was the absence or limited presence of arboreal species and certain aquatic, semi-aquatic, and fossorial-burrowing species on mined lands. The basis of this difference lies in the differing physical characteristics of the vegetative and substrate components present in the natural communities and mined land phases.

Based on geographical distribution and habitat availability, 235 species of birds could occur in the Swift Creek natural and mined land communities. Based on IPA counts (Blondel et al., 1970), 163 species (69 percent) were confirmed during fall/winter counts. Total numbers for expected and observed species were greater on mined lands than in natural communities (Table 2.7-9) and it is expected that 70 species (30 percent of the total) would not have been found in the area if not for the mined lands. The greater diversity of species in the mined areas is a result of the increased occurrence of aquatic habitat offered by settling areas. The greater number of species observed in mined lands was influenced somewhat by the increased visibility and range for sighting in open mined areas versus the closed canopy of woods or an area with thick vegetative cover.

Species composition of the natural communities along Swift Creek drainage and the mined lands is somewhat different, with an increase in different species of aquatic and semi-aquatic species in mined lands. Use of settling areas by aquatic and semi-aquatic species is demonstrated by the presence of a substantial rookery in a settling area on the Suwannee River Mine (Table 2.7-10).

Due to winter conditions, the herpetile fauna could not be adequately and quantitatively assessed. A qualitative approach was used to determine herpetile community components of both the Swift Creek drainage and the Swift Creek and Suwannee River mined lands.

Table 2.7-4 One-way Analysis of Variance for Macroinvertebrate Data Collected from Natural Substrates, Comparing Pooled Swift Creek Stations with the Pooled Controls

1. DIVERSITY

Swift Creek	SC-2	SC-4A	SC-4B	SC-6	SC-7	SC-9	$\bar{x}$	s
	0.56	2.89	2.93	3.26	1.21	2.60	2.24	1.09
	2.38	3.02	2.16	3.06	3.22	3.28	2.85	0.47
Control Stream	CB-1	CB-2	CB-3	RC-2	HC-1	RO-2		

ANOVA

Source	Ss	df	MS	F
Treatment	1.12	1	1.12	1.59
Error	7.04	10	0.70	
Total	8.17	11		

$F_{.05,1,10} = 4.96$

2. BIOMASS (g/m^2)

Swift Creek	SC-2	SC-4A	SC-4B	SC-6	SC-7	SC-9	$\bar{x}$	s
	0.313	0.667	1.125	2.68	1.917	0.154	1.14	0.99
	0.467	0.534	2.971	0.158	0.916	2.053	1.18	1.10
Control Stream	CB-1	CB-2	CB-3	RC-2	HC-1	RO-2		

ANOVA

Source	Ss	df	MS	F
Treatment	0.0049	1	0.0049	0.0045
Error	10.86	10	1.09	
Total	10.87	11		

$F_{.05,1,10} = 4.96$

Table 2.7-5 One-way Analysis of Variance for Macroinvertebrate Data Collected from Artificial Substrates, Comparing Pooled Swift Creek Station with Pooled Controls

1. DIVERSITY

Swift Creek	SC-2	SC-4A	SC-4B	SC-6	SC-7	SC-9	$\bar{x}$	s
	2.04	1.84	2.36	2.60	1.92	1.84	2.10	0.31
	2.34	2.25	2.23	1.70	2.44	2.50	2.24	0.29
Control Stream	CB-1	CB-2	CB-3	RC-2	HC-1	RO-2		

ANOVA

Source	Ss	df	MS	F
Treatment	0.06	1	0.06	0.69
Error	0.90	10	0.09	
Total	0.96	11		

$F_{.05,1,10} = 4.96$

2. BIOMASS (g/m^2)

Swift Creek	SC-2	SC-4A	SC-4B	SC-6	SC-7	SC-9	$\bar{x}$	s
	0.366	2.109	1.199	0.278	0.568	0.208	0.79	0.74
	0.168	0.100	0.017	0.289	0.100	0.346	0.17	0.13
Control Stream	CB-1	CB-2	CB-3	RC-2	HC-1	RO-2		

ANOVA

Source	Ss	df	MS	F
Treatment	1.15	1	1.15	4.07
Error	2.82	10	0.28	
Total	3.96	11		

$F_{.05,1,10} = 4.96$

Table 2.7-6 One-way Analysis of Variance for Fish Diversity Indices Between Swift Creek and Local Control Streams

---

1. All Swift Creek Stations vs. All Control Stations:

	Average Station Diversity					$\overline{X}$	S
Swift Creek	0.44	1.47	0.71	0.18	1.28	0.82	0.55
Control	1.44	1.75	1.6	1.53	--	1.58	0.13

ANOVA

Source	SS	df	MS	F
Treatments	1.30	1	1.30	7.25
Error	1.25	7	0.18	
Total	2.55	8		

$F_{tab.,.05} = 5.59$

2. Representative Swift Creek Station vs. Individual Control Stations:

	Replicate Diversity			$\overline{X}$	S
SC-4	1.92	1.39	1.09	1.47	0.42
RO-2	2.43	1.58	0.31	1.44	1.07
CB-2	1.58	1.92	--	1.75	0.24
HC-1	1.3	00	1.9	1.60	0.42

ANOVA

Source	SS	df	MS	F
Treatments	0.14	3	0.05	0.10
Error	2.87	6	0.48	
Total	3.01	9		

$F_{tab,.05} = 4.76$

Table 2.7-7 One-way Analysis of Variance for Fish Biomass Estimates Between Swift Creek and Local Control Streams

1. All Swift Creek Stations vs. All Control Stations:
Mean Biomass (kg/ha) Per Station

Swift Creek	1.83	4.04	26.37	57.10	16.52	$\overline{x}$ = 21.17, S = 22.4
Control	3.25	2.5	2.07	0.12	--	x = 1.99, S = 1.34

ANOVA

Source	SS	df	MS	F
Treatments	818.09	1	818.09	2.85
Error	2012.45	7	287.49	
Total	2830.54	8		

$F_{.05,1,7} = 5.59$

2. Representative Swift Creek Station vs. Each Control Station:
Replicate Biomass (kg/ha)

SC-4	4.38	2.24	5.51	$\overline{x}$ = 4.04, S = 1.66
RO-2	5.46	3.85	0.44	x = 3.25, S = 2.56
CB-2	7.01	0.49	0	x = 2.5, S = 3.91
HC-1	1.12	0	5.08	x = 2.07, S = 2.67
RC-2	0.37	0	0	x = 0.12, S = 0.21

ANOVA

Source	SS	df	MS	F
Treatments	26.18	4	6.55	1.03
Error	63.63	10	6.36	
Total	89.81	14		

$F_{.05,1,7} = 3.48$

Table 2.7-8 Comparison of Small Mammals as Assessed by Traplines in Natural and Mined Communities

Community	Habitat/Mine Phase	HABITAT/MINE PHASE Number of Species	HABITAT/MINE PHASE Trap* Success	COMMUNITY TOTAL Number of Species	COMMUNITY TOTAL Trap* Success
Swift Creek Watershed	High pinelands	2	1.7	5	1.8
	Pine-palmetto flatwoods	3	2.8		
	Mixed hardwood systems	1	1.1		
	Swamp systems	2	1.7		
Swift Creek Mine Complex	Unreclaimed mine	5	5.4	5	3.2
	Sand tailings	1	0.4		
	Inactive settling area	2	3.8		
Suwannee River Mine Complex	Reclaimed area	3	10.8	5	8.7
	Active settling area	2	5.0		
	Inactive settling area	4	8.3		
	Unreclaimed mine	4	13.3		
	Sand tailings	2	3.3		

* Based upon an index of number of individuals captured/100 trap-nights.

Table 2.7-9 Expected and confirmed bird species in Swift Creek natural communities and Swift Creek/Suwannee River mined lands

Site	No. Expected Species	No. Confirmed Species	Percent Confirmed Species
Natural Communities			
Pine flatwoods	82	20	24.4
Sandhills	68	15	22.1
Southern mixed hardwoods	90	18	20.0
Cypressheads	27	10	37.0
Bayheads	44	16	36.4
Mixed hardwood swamps	60	30	50.0
Agricultural lands	68	32	47.1
Mined Lands			
Active settling area	128	49	38.3
Inactive settling area	137	44	32.1
Reclaimed area	147	58	39.5
Unreclaimed mined area	132	26	19.7

Table 2.7-10 Estimated bird pairs of rookery in active settling area 8 on Suwannee River Mine

Species	No. of Pairs
Double-crested Cormorant	250
Anhinga	150
Great Egret	150
Cattle Egret	4500-5000
Snowy Egret	50
Little Blue Heron	200
Black-crowned Night Heron	75
White Ibis	2500
Green Heron	12

Table 2.7-11. Potential and Confirmed Terrestrial Vertebrate Species in Swift Creek Natural Communities and Mined Lands

Vertebrate Group	Potential Total Species	Species Confirmed on Swift Creek Natural Communities	Species Confirmed on Mined Lands
Mammals	51	28	21
Birds	235	64	84
Reptiles	63	33	10
Amphibians	38	16	11
Total	387	141	126

Table 2.7-12. Summary of Occurrence of Rare and Endangered Species

Taxon	Number Probable	Number Confirmed Natural Communities	Number Confirmed on Mined Lands
Mammals	10	3	1
Birds	24	11	16
Reptiles	6	3	1
Amphibians	3	0	0
Fish	4	2	0
Total	47	19	18

Based on geographical distribution and habitat requirements, 101 species could occur. Of these 49 (48.5 percent) have been observed in the natural communities along Swift Creek and 21 (20.8 percent) on the mined lands.

Generally, the terrestrial vertebrate fauna of the Swift Creek natural communities is typical of the region. A total of 387 terrestrial vertebrate species potentially occur within the area (Table 2.7-11). Of these 141 (36.4 percent) were confirmed on the Swift Creek natural communities and 126 (32.6 percent) were confirmed on mined lands. The fauna of the mined lands is somewhat different in species composition than the natural community fauna. Basic differences lie in omission of certain specialist species from the mined lands, such as deep woods species, many arboreal types, and some burrowing-fossorial types. Other specialists are somewhat more obvious and abundant on mined lands than in the natural communities. This is particularly true for aquatic and semiaquatic birds. Settling areas on mined lands offer a functional habitat as evidenced by the rookery established in the active settling area on the Suwannee River Mine.

2.7.4 OTHER IMPORTANT BIOLOGICAL CONSIDERATIONS

2.7.4.1 Unique Natural Communities

The southern mixed hardwood community is considered the climatic upland climax community in the area. However, the vegetative community type is restricted to small isolated woodlots and strands along the Suwannee River and its tributaries. These isolated areas provide diversity, as well as additional "edge" within the pine flatwoods/ cypresshead/bayhead system. This edge is important to wildlife species in offering food resources and nesting habitat. No unique natural communities exist on the proposed SCCC plant site.

2.7.4.2 Endangered, Threatened, or Rare Animals and Plants

Forty-seven endangered, threatened or rare vertebrate species have been considered as potentially occurring within the Swift Creek drainage area (Table 2.7-12). Of these, 19 (40.4 percent) were confirmed along the Swift Creek drainage and 18 (38.3 percent) were confirmed on the mined lands. The majority of this category are bird species which are aquatic in nature (herons and egrets). The availability of functional aquatic habitat on mined lands (settling areas) is reflected in the number of the rare and endangered avifauna present. Twenty species of plants are also considered in this category with two (10 percent) being confirmed as on-site in natural communities. No plants from this category are expected to occur on the mined lands.

2.7.4.3 Migratory Wildlife and Habitat

Approximately 30 (13 percent) birds of the 235 suspected to occur are nonmigratory. The other 205 (87 percent) are either transients, winter residents, summer residents, or local nonmigratory subspecies that share the area with northern migratory subspecies during the winter. Natural communities along the Swift Creek drainage basin primarily provide habitat for wintering or transient field and woodland birds. Very little open water habitat exists. The mined areas provide large amounts of aquatic habitat. It is estimated that 70 species of birds would not be found in the area if not for the man-made habitats provided by the mine lands. In addition, species that would normally occur would probably occur in lower numbers if not for the manmade habitats.

2.7.4.4 Wildlife Benefits of the Area to Man

There is no public game management in the study area, although private hunting is allowed on much of the commercially owned forests and trapping was observed on Swift Creek. Duck hunting is permitted by Occidental on some clay settling areas. These areas also attract non-consumptive use by groups, such as the Audubon Society. There exists a good sport fishery on the Suwannee River but the use of this resource is moderate and primarily confined to local residents. Some fishery use and trapping was observed along Swift Creek.

2.7.4.5 Agricultural and Forestry Resources

Agriculture occupies a significant part of the Hamilton County economy. Approximately 68,000 acres (21 percent of total land area) is in cultivation. Primary crops are corn, tobacco, soybean, rye, and millet. Principal livestock includes poultry, hogs, and cattle. About 260,000 acres (79 percent of total land use) is in forest, of which 60 percent is in pine forests intensely managed for fiber production (i.e., pulpwood).

2.7.4.6 Trends in the Area

Countywide, all agricultural lands suitable for this purpose have been developed and no expansion of the agricultural base is expected. Similarly, forest land in the county is also at a stable level, but the volume of marketable timber has increased from 1 percent to 3 percent annually since 1970. The most significant land use trend in the area is the growth of phosphate mining and related activities. Phosphate mining and reclamation will occur in the vicinity of the proposed plant site. Portions of the area have been mined and the owners of the timber have clearcut the area in anticipation of mining. A limited reestablishment of an upland successional series should recur in the cutover area prior to initiation of mining. The characteristics of mined/reclaimed systems have been presented in Section 2.7 of the Resource Document.

2.7.5 PROPOSED SWIFT CREEK CHEMICAL COMPLEX SITE

The 650 acres which will comprise the SCCC are highly disturbed lands. Portions of the area have been mined and the remainder has been cleared with the expection of several highly modified cypress domes. The area presently supports several invader species including the Hispid cotton rat, Black racer, Mockingbird, Dogfennel and Baccharis. These same species would recolonize any disturbed area (e.g. farmlands, road edge, etc.) With the completion of the facilities, the surrounding lands (dike edge, building borders) will provide similar habitat. The disturbed nature of the area (i.e. mined lands, site prepared, drained cypress domes) make it an unlikely place to find endangered or other listed species. These species for the most part are listed because of limited habitat flexibility. Generally, wildlife will not be affected by the construction although air emissions may affect wildlife and wildlife habitat. These are discussed elsewhere.

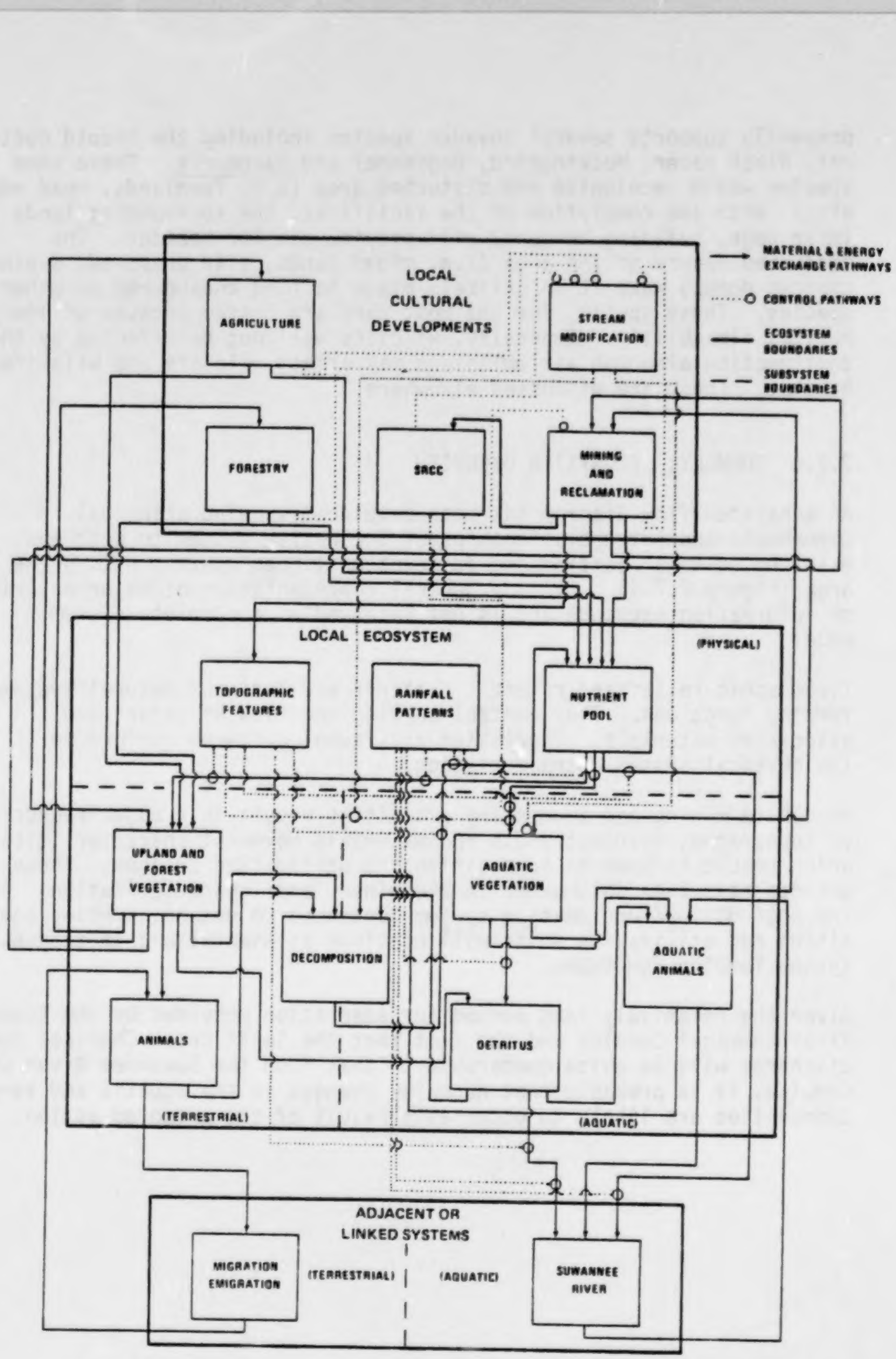
2.7.6 SUMMARY: ECOSYSTEM OVERVIEW

An ecosystem flow diagram has been developed showing principal components and interrelationships of the native system to both the existing cultural setting and adjacent or linked systems not in the area (Figure 2.7-4). It is a general representation of major material or information exchange and is not intended as a complete system model.

Topographic relief and rainfall patterns are dominant natural system forcing functions. They control pooling and flow of waters and associated materials. Vegetation and faunal patterns conform to the physical system characteristics.

Phosphate mining and processing activities result in a major reordering of topography, nutrient pools and materials movement characteristics which result in species composition and utilization changes. These changes have been documented in the mined lands characterization. As the post mining/ reclamation system continues to mature, species composition and utilization shift will continue as adaptations to changes in system forcing functions.

Given the relatively long period for adaptation provided by the Suwannee River Chemical Complex and the fact that the Swift Creek Chemical Complex discharge will be quite comparable to that from the Suwannee River Chemical Complex, it is probable that no major changes in the aquatic and terrestrial communities are likely to occur as a result of the proposed action.


MATERIAL & ENERGY EXCHANGE PATHWAYS
CONTROL PATHWAYS
ECOSYSTEM BOUNDARIES
SUBSYSTEM BOUNDARIES
LOCAL CULTURAL DEVELOPMENTS
AGRICULTURE
STREAM MODIFICATION
FORESTRY
SRCC
MINING AND RECLAMATION
LOCAL ECOSYSTEM
(PHYSICAL)
TOPOGRAPHIC FEATURES
RAINFALL PATTERNS
NUTRIENT POOL
UPLAND AND FOREST VEGETATION
AQUATIC VEGETATION
AQUATIC ANIMALS
DECOMPOSITION
ANIMALS
DETRITUS
(TERRESTRIAL)
(AQUATIC)
ADJACENT OR LINKED SYSTEMS
MIGRATION EMIGRATION
(TERRESTRIAL)
(AQUATIC)
SUWANNEE RIVER

ECOSYSTEM DIAGRAM OF THE AREA OF CONCERN SHOWING PRINCIPAL SYSTEM COMPONENTS , FLOWS AND CONTROLLING INFLUENCES

FIGURE 2.7-4

LIST OF REFERENCES
(Section 2.7)

Blondel, J., L. Ferry and B. Frochot (1970), "La methode des indices pouctuels d' ayifauna par stations d' encoute"; *Alada* 38:55-71.

2.8 SOCIOECONOMIC ENVIRONMENT OF THE AREA OF IMMEDIATE IMPACT--HISTORICAL PERSPECTIVE

The area in which Occidental Chemical Company operates in North Florida is a predominantly rural area which is sparsely populated compared to Florida as a whole. There are three counties (Columbia, Hamilton, and Suwannee) which will receive the bulk of the local socioeconomic impacts of the proposed expansion, although Duval County will also be affected moderately from expansion for shipping at the existing port facility. However, the economic base of Duval County is large and the direct economic impact, in terms of increased employment and payrolls, are small.

Attention therefore is concentrated primarily upon Columbia, Hamilton, and Suwannee counties. Duval County, for the most part, is treated as a part of Florida as a whole.

Historic baseline data and baseline projections for the state of Florida and for the three-county area of immediate impact are presented in the Resource Document. Key data are, however, presented in Table 2.8-1 which gives a summary view of the socioeconomic character of the impact area relative to Florida as a whole.

It is essentially a low density rural area which had relatively little unemployment in 1970 and a low labor force participation rate. By 1975, however, the unemployment rate in the area had increased sharply although it was still below that for Florida as a whole. Hamilton County, in particular, has experienced employment and income growth which was related at least in part to Occidental.

Section 2.8.2 of the Resource Document contains detailed projections of socioeconomic variables for Florida and the impact area to the year 2000. Section 3.4.5 of this report presents a summary of these baseline projections along with those which include the impacts of Occidental's expansions. The table below shows the three-county relationship to the statewide picture.

Table 2.8-1 Key Historic Socioeconomic Data for Florida and Columbia, Hamilton, and Suwannee Counties

	Columbia County	Hamilton County	Suwannee County	State
Population (1975)	28,793	8,641	18,866	8,485,230
Growth Rate: 1960-1970	26%	1%	4%	37%
Growth Rate: 1970-1975	14%	11%	21%	25%
Net Migration Rate: 1960-1970	+11%	-12%	-6%	+27%
Net Migration Rate: 1970-1975	+ 9%	+ 7%	+18%	+23%
Rural Population (1970)	40%	100%	56%	20%
Percent Economy Based on Agriculture (1970)	10%	30%	18%	5%
Median Family Income (MFI) 1970:	$7,354	$5,733	$5,903	$8,267
Percent Below State MFI	11%	31%	9%	0

2.9 EXISTING RADIOLOGICAL ENVIRONMENT

The following subsection will attempt to describe the background condition of the natural radiation environment in the absence of the proposed facility. The chemical plant must receive mined and processed feed material and mining this feed cannot be considered as unassociated with the proposed chemical plant. It must, at least, be addressed as a potential secondary impact. The only radionuclides having potential significant impact are those of the uranium-238 decay series. The discussion will center upon the natural and disturbed condition of these radionuclides.

2.9.1 RADIONUCLIDES IN PHOSPHATE DEPOSITS

Phosphate deposits are found all over the globe in rocks ranging in age from very young (less than 10,000 years old) to over 600 million years old. For perspective, U-238 has a half life of 4,500 million years. Apatite is by far the most common mineral of the phosphate group.

In order to understand the concentration of uranium, it is important to first understand the formation of the apatites. Many theories for the formation of apatites in Florida have been presented in the literature. Although they vary considerably in detail, most hypotheses generally agree that apatite was deposited during the middle Miocene when the oceanic environment of the area was geochemically conducive to the precipitation of phosphate from the sea water. Once deposited, the apatite underwent extreme reworking due to the repeated rise and fall of sea level that occurred during later ages.

Primary apatite contains only trace amounts of uranium, but when submitted to extensive marine reworking the uranium content of these apatites may be increased to as much as 0.1 percent. Therefore, the association of uranium with Florida phosphate deposits is to be expected. Once emplaced in the apatite mineral structure, the uranium may be redistributed throughout the formation. There are distinct differences in weathering and leach zone formation between the north and west central Florida deposits. It is generally known that the Hawthorn Formation in northern Florida contains, on the average, less uranium than phosphatic sediments in west central Florida.

The physical characteristics of the apatite particles are different in that the Bone Valley apatites of west central Florida tend to be of pebble size and thus larger than the sand-sized ore contained in the Hawthorn Formation deposits of Hamilton County. The upper portion of the Bone Valley Formation has been leached, altered to aluminum phosphates, and enriched in uranium through ground water processes. This zone is widespread, though discontinuous, throughout the west central Florida phosphate district. A geologically similar zone does appear in northern Florida deposits; however, it seems to be more generally limited and thinner than that of the Bone Valley Formation.

2.9.1.1 The Uranium Series

In order to understand the hazard posed by disturbing the location and both the physical and chemical state of the natural radioactivity present in the phosphate matrix, a clear understanding of the complexities of the uranium decay series is required.

Uranium has two naturally occurring isotopes, uranium-238 and uranium-235. The uranium-238 series has a longer half-life and at present accounts for 99.3 percent of the naturally occurring uranium. Thorium-232 represents the parent radionuclide of another naturally occurring series, however, the concentration of thorium in north Florida formations is small compared to uranium and does not present a significant enough hazard potential to warrant consideration.

2.9.1.1.1 Uranium Equilibrium

In the uranium-238 series, decay proceeds usually through 13 intermediate radionuclides, called daughters, to a stable endpoint of the element lead with a mass number of 206. The radionuclides in the series are diagrammed in Figure 2.9-1.

The nature of the series is such that a condition of equilibrium is achieved if the entire series is contained in a "sealed" location over a long period of time. In other words, a geological sample containing 100 pCi of U-238 may also contain 100 pCi of Th-234, 100 pCi of Pa-234, 100 pCi of U-234, and so on, through 100 pCi of Po-210.

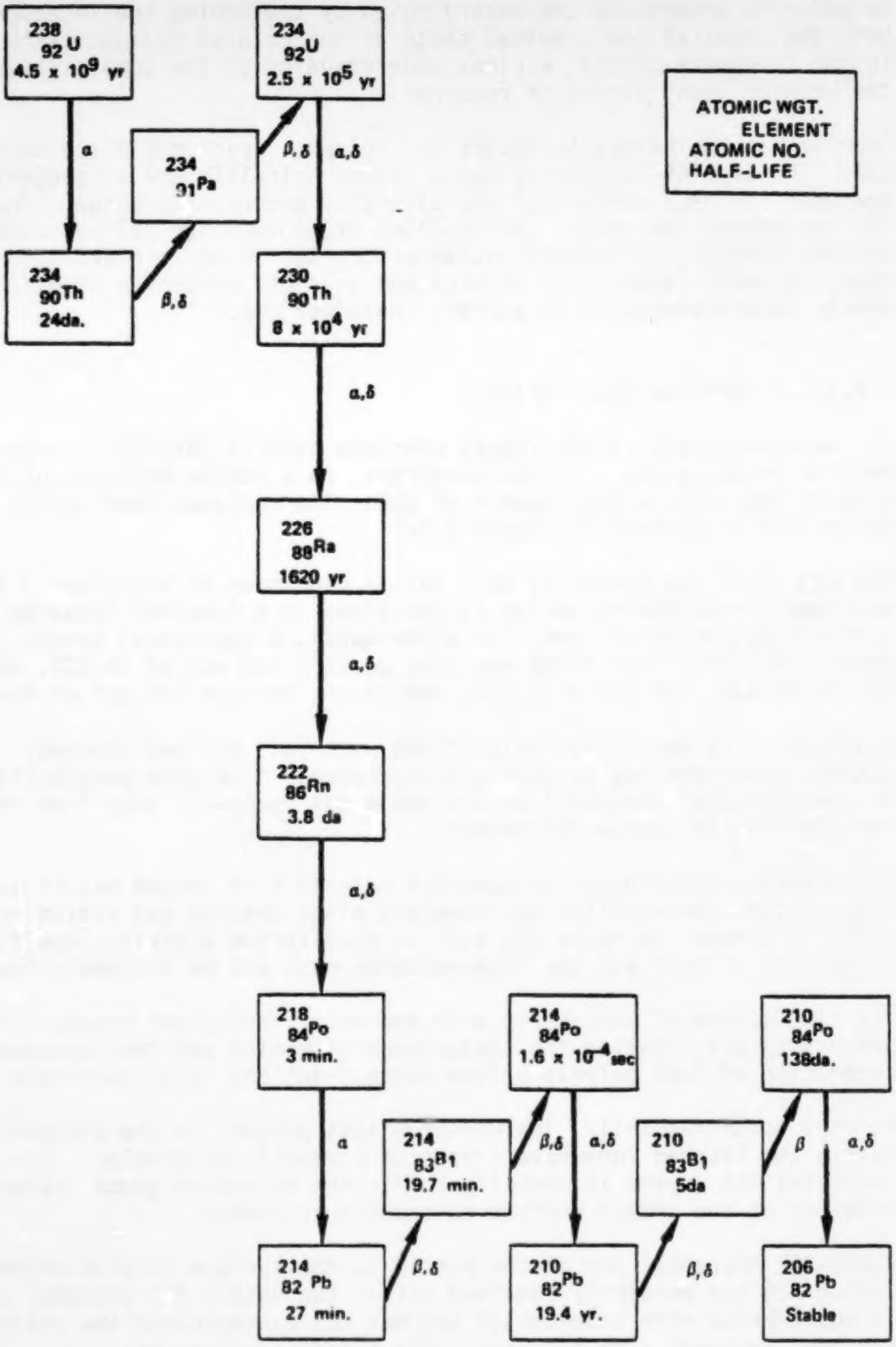
Equilibrium is maintained only if the materials are undisturbed. Natural phenomena may produce a disturbance. A notable possibility is the potential transport of the noble gas radon-222 away from the location of its radium-226 parent.

Differential dissolution of specific materials by ground waters would also disturb the equilibrium; however, since uranium and radium are normally present in rocks and soil at equilibrium activity levels, the solubility of each and the intermediates must all be extremely low.

The manufacture of phosphoric acid and other fertilizer products is of prime interest, however the disturbance of mining and the subsequent separation of feed materials from waste fractions is of secondary interest.

As they occur naturally, the radionuclides present in the phosphate matrix and leached zone have presented virtually no problem. The soil overlying the layers is normally sufficient to reduce gamma radiation exposure at the ground surface to background levels.

Radon-222 transport out of the matrix to the surface is also minimal. Radium-226 has evidently remained within the matrix for geologic ages in equilibrium with uranium-238 and has not contaminated the shallow and deep aquifers with any chemically significant amounts.


ATOMIC WGT.
ELEMENT
ATOMIC NO.
HALF-LIFE
238 92 U 4.5 x 10^9 yr
α
234 90 Th 24da.
β,δ
234 91 Pa
β,δ
234 92 U 2.5 x 10^5 yr
α,δ
230 90 Th 8 x 10^4 yr
α,δ
226 88 Ra 1620 yr
α,δ
222 86 Rn 3.8 da
α,δ
218 84 Po 3 min.
α
214 82 Pb 27 min.
β,δ
214 83 Bi 19.7 min.
β,δ
214 84 Po 1.6 x 10^-4 sec
α,δ
210 82 Pb 19.4 yr.
β,δ
210 83 Bi 5da
β
210 84 Po 138da.
α,δ
206 82 Pb Stable

URANIUM-238 DECAY SERIES

FIGURE 2.9-1

Mining, however, produces a considerable disturbance of this natural condition leading to many new transport pathways that must be addressed. Mining may cause the higher activity leached zone material and small quantities of the matrix to be redeposited near the ground surface upon reclamation. The physical character of the material containing the activity is changed as a new geohydrology is established. The by-product materials from the processing of the phosphate matrix contain various amounts of uranium and its decay series.

In some cases, mined land is reclaimed with by-product materials from the processing of the phosphate matrix. These materials contain approximately one-third of the uranium originally present in the matrix. Physical processing does not appreciably alter the equilibrium from uranium-238 through radium-226.

In phosphoric acid production, the radioactive equilibrium is severely disrupted with uranium-238 appearing primarily in the phosphoric acid and radium-226 precipitated with the gypsum. The fertilizer concentrations of each radionuclide materials reflect the mix and processing of the ingredients. The impact of this redistribution of radioactive materials is addressed in Section 3.5.

2.9.1.1.2 Radon Progeny

The uranium-238 decay scheme equilibrium is highly dependent upon the mobility of the radon-222, an inert gas. In the neutral state, most of the radon-222 produced in a phosphate matrix would not escape the media. Mining, beneficiation and chemical processing not only alters the location and chemical condition of the radium-226 but may increase the probability that radon-222 will be able to diffuse from the site at which it was created. The rate of movement through the soil-air interface will be in units of pCi/m^2 sec and is termed "radon flux." Very few radon flux measurements have been made in north Florida. Roessler et al. (1976) report one flux measurement in Hamilton County on unaltered lands at 0.1 pCi/m^2 sec.

The airborne radon-222, whether in the open air, near industrial sources, or inside homes, will decay and an approach to equilibrium between the next four daughters (polonium-218, lead-214, and polonium-214) will start. These four radionuclides are known as the radon progeny. Airborne radon progeny concentrations are customarily expressed in "Working Level" units.

There is one other way to view the uranium decay series. The radionuclides uranium-238, uranium-234, thorium-230, radium-226 and polonium-210 are all long lived radionuclides that could become airborne in dusty operations or other mechanisms. The most critical industry operations with regard to these radionuclides are elemental phosphorus production and rock dryers. Neither operation is associated with the proposed facility. No data on these emissions are available from present operations at the SRCC.

2.9.1.2 Background Radioactivity

This section will review the various background radiation sources with particular emphasis on comparing the proposed site to USA averages and west central Florida levels. Table 2.9-1 summarizes the estimated average background dose to United States citizens from natural radiations and compares it to estimates from other man-made sources.

In the continental United States the external terrestrial radiation arises primarily from gamma ray emissions of the thorium series, the uranium series and potassium-40. However, in Florida the contribution to the external terrestrial radiation component by the uranium series probably accounts for a higher percentage in virgin areas and all of the man-enhanced increases. The overall average level in Florida is lower than the national average given in Table 2.9-1. The total average external background radiation level (cosmic + terrestrial) in Florida is expected to be between 6.3 and 4.7 μR/hr (55 and 41 mrem/yr), (see Resource Document, Section 2.9.1).

In early 1976, a field survey for external gamma radiation levels existing on the Occidental Chemical Company property was conducted (Sholtes & Koogler Environmental Consultants, 1976). Virgin land (including lands to be mined in the next three years), lands being mined, and reclaimed lands were included in the survey.

The average value found in this survey for virgin land, lands being mined and reclaimed lands were 5 μR/hr, 5 μR/hr, and 7.9 μR/hr, respectively. Typical background gamma radiations for north Florida are compared to west central Florida in Table 2.9-2 (after Roessler, 1977).

2.9.1.3 Subsurface Radioactivity

Since the origin of the uranium in the deposits is similar to the phosphate, it should be evident that the concentration of uranium should follow the concentrations of phosphate: a low concentration in the overburden and a high concentration in the matrix. The actual distribution is slightly different. In both north Florida and west central Florida mining regions, the radioactivity is low at the surface, increases gradually and then more rapidly with depth and is most concentrated in or just above the matrix. Uranium and radium are in general equilibrium. If present, the leached zone is usually marked by high radioactivity.

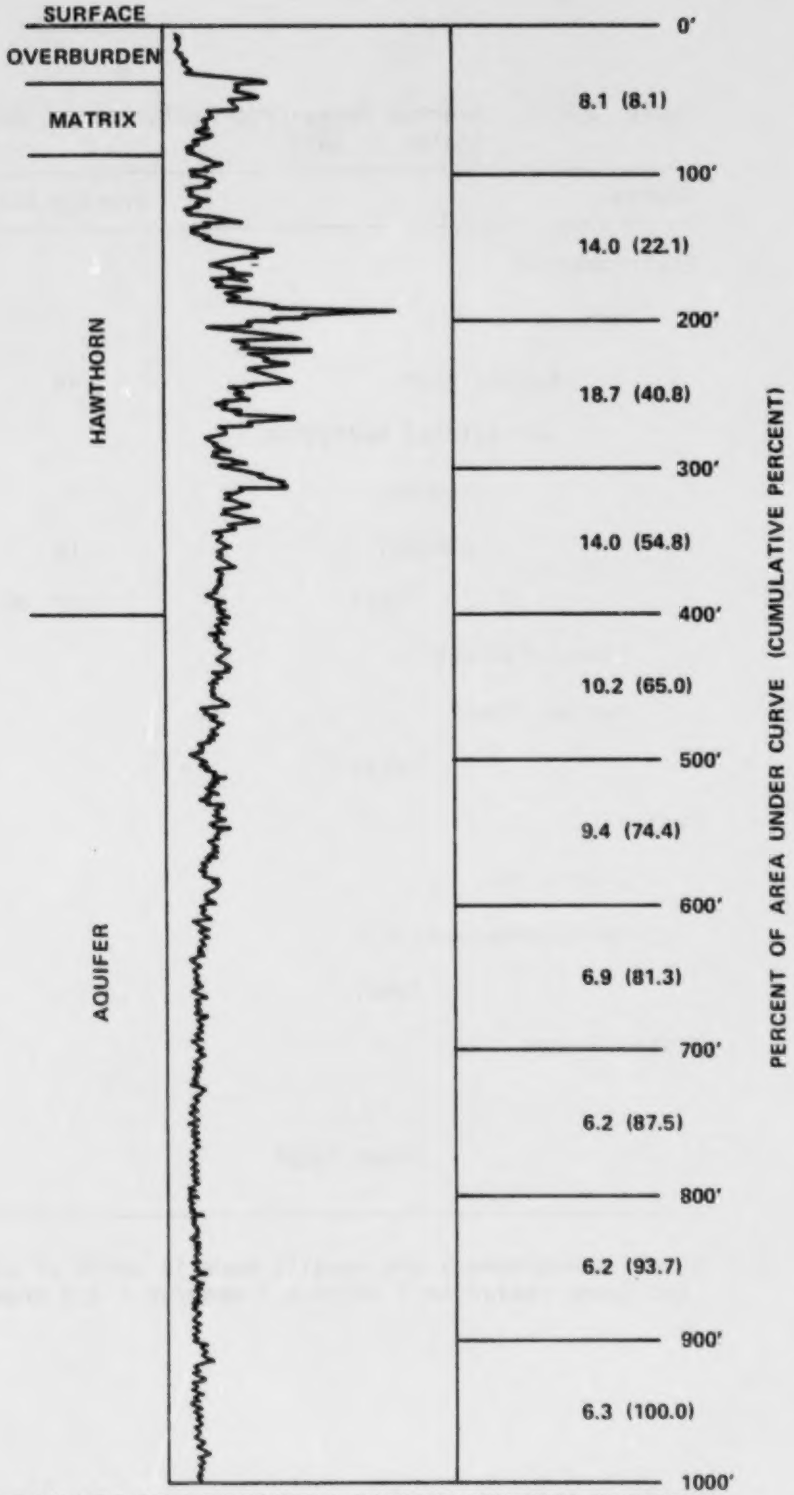
Since a major fraction of the gamma radiation level in Florida is related to the uranium series, gamma logs of wells should also reflect this general profile. A gamma well log from west central Florida is shown in Figure 2.9-2 (Ardaman & Associates, 1977).

The activity (also relative radium concentration) increases nearly linearly with depth to approximately 35 feet where the rate sharply increases as does the phosphate level and then falls gradually to around the 100-foot mark. The activity begins to increase again below

Table 2.9-1 Average Doses From Radiation in the United States in 1970

Source	Average Dose, mrem/year*		
Environmental			
Natural			
Cosmic Rays	44		
Terrestrial Radiation			
External	40		
Internal	18		
Total	102 →	102	
Global Fallout		4	
Nuclear Power		0.003	
Total		106 →	106
Medical			
Diagnostic		72	
Radiopharmaceuticals		1	
Total		73 →	73
Miscellaneous			3
Grand Total			182

*Field measurements are usually made in units of μR/hr. For X- and gamma radiation 1 μR/hr = 1 mrem/hr = 8.8 mrem/yr.



GAMMA-RAY LOG OF A DEEP WELL IN WEST CENTRAL FLORIDA

FIGURE 2.9-2

Table 2.9-2 Mean Gamma Field Averages and Ranges by Land Type in the North and Central Florida Mining Regions

	OCCIDENTAL CHEMICAL COMPANY			WEST CENTRAL FLORIDA		
Land Type	N	Average Mean Gamma Level (μR/hr)	Range of Means Levels (μR/hr)	N	Average Mean Gamma Level (μR/hr)	Range of Mean Levels (μR/hr)
Virgin	1	4.0	--	8	4.7	4.3-5.0
Overburden	1	7.9	--	3	8.3	7.1-10.3
Tailings	1	9.8	--	6	10.3	7.4-12.8
Debris	--	---	--	4	18.4	16.1-21.0
Capped Clays	--	---	--	2	23.0	21.7-24.3

Source: After Roessler 1977

the matrix and reaches a peak at about the 200-foot level. It then decreases beyond the 350- to 400-foot level and falls off slowly with depth.

This distribution of activity with depth is also reflected in the radium profiles obtained for the site.

An examination of Figure 2.9-2 indicates the overburden and mineable matrix represents only 8.1 percent of the total activity in the 100-foot column. Note that the primary aquifer lies below the Hawthorn formation.

The Osceola National Forest study (Miller, 1977) incorporated data from a large number of wells, most of which were gamma logged and a general pattern emerges from a review of the numerous gamma logs. Many indicate:

1. A rapid rise in activity to the near-matrix depth.
2. The high activity of the matrix.
3. A brief decrease in activity.
4. Sporadic high levels of activity throughout the Hawthorn formation.
5. A precipitous drop in activity as the aquifer is traversed.

In order to relate the findings concerning the gamma logs in west central Florida and the Osceola area to the present study, gamma logs were obtained for three wells on the Occidental property. The logging of well SC-3-E is shown in Figure 2.4-2.

Although this topic will be discussed in more detail in section 3.5, it should be noted here that the monitor well sets described in Section 2.6.3 draw water from locations indicating high gamma log activities. Because of existence of higher radium contents in strata from which water is drawn for monitoring purposes, it may be exceedingly difficult to determine the existence of radium seepage from other locations. Concentrations of radium-226 found in water samples from these wells may be a direct function of the local environment and completely mask radium transported from nearby ponds or gypsum stacks.

The distribution of activity from core data appears to follow the pattern of the gamma log response. Table 2.9-3 compares the subsurface radioactivity data of Groome (1977) for north Florida against west central Florida by sample type.

Groome's data on the matrix at the two sites reinforce the known difference between the two locations. The averages indicate a matrix concentration of radium-226 in north Florida that is about 20% of the west central Florida values.

Table 2.9-3 Comparison of Radium-226 Concentrations: Occidental Property versus West Central Florida

Sample Type	Occidental Property		West Central Florida	
	No. of Samples	Radium-226 pCi/g	No. of Samples	Radium-226 pCi/g
Topsoil				
Average	4	0.5	4	1.3
Overburden				
Average at weighted Overburden	2*	3.6	3*	4.0
Matrix				
Average of Composite Samples	4	8.6	6	37.6

* Number given is number of profiles used in the weighted average.

Source: After Groome 1977 as updated by Roessler et al., 1977

2.9.1.4 Surface Water Quality

Radium-226 in surface waters of the USA is generally low (between 0.01 and 0.1 pCi/l) except for certain locations such as mineral springs, waters with high solids content, and waters that drain fertilized farming areas. This distribution can be seen in Table 2.9-4. The latter entries are specific to Florida and are taken from the impact statement on the potential mining in the Osceola National Forest and the Resource Document for this EIS.

2.9.1.5 Ground Water Quality

The potential of groundwater contamination with radium-226 or other contaminants due to phosphate mining operations is a concern. The most extensive review of the literature and data analysis for west central Florida has been undertaken by Kaufmann and Bliss (1977). They statistically analyzed available radium data from 1966 and from 1973-1976 in three strata: upper water table, Upper Floridan aquifer, and Lower Floridan aquifer. Each water resource was considered in three geographic areas of west central Florida: mined (mineralized) areas, unmined mineralized areas, and nonmineralized areas. The basic data summary is shown in Table 2.9-5.

The geometric mean radium-226 in the water table aquifer was 0.17 pCi/l in the unmined mineralized areas and 0.55 pCi/l in the mined areas. The statistical tests indicate no significant difference between the 0.17 and 0.55 pCi/l of radium-226 in the water table aquifers of the unmined and mined areas.

When the Upper and Lower Floridan aquifer data were considered, mined areas and nonmined areas were all approximately equal. The Floridan aquifer had higher concentrations of radium-226 in the nonmineralized areas.

Kaufmann and Bliss did not consider gamma logs of deep wells. As discussed previously, gamma logs to 1,000 feet show considerable radioactivity in the Hawthorn formation overlaying the Floridan aquifer. The gamma logs strongly suggest that the Lower Hawthorn itself may be a source of radium-226 in the Floridan aquifer.

Studies of radioactivity in the groundwaters of unmined sections of northern Florida are limited. Two will be reviewed here--a study of radium-226 in groundwaters in Alachua County (Palmer, 1977) and the Osceola Mining Impact Study (Miller, 1977). Studies of radioactivity in groundwaters on the site are discussed in Section 3.5.

Palmer's data indicated an average gross alpha level for 20 wells of 8.1 pCi/l. The average radium-226 concentration in the wells showing results greater than the lower limit of detection was 2.6 pCi/l. The gross alpha to radium-226 ratio was about three.

Table 2.9-4. Radium-226 in Surface Waters in the U.S.A. and Florida

Type	Location	Radium-226 pCi/l	Reference
River Waters	Average North America	0.03	Lowder
Mississippi River	St. Louis, MO	1.2-2.9	Lowder
Great Salt Lake	Utah	5	Lowder
Curie Spring	Boulder, CO	267,000	Lowder
Ohio River	Pennsylvania	0.6	Lowder
Surface Water Supply	Chicago, IL	0.03	Holtzman
Lithia Springs	Lithia, FL	0.68	Irwin
Alafia River	Lithia, FL	0.06	Irwin
Peace River	Ft. Meade, FL	0.12	Irwin
Proposed Four Corners Mine (7 stations, 18 samples)	Hillsborough and Manatee Counties, FL	0.18	Morton
Middle Prong St. Mary's River	Osceola National Forest	0.08	Miller
Deep Creek	Osceola National Forest	0.06	Miller
Robinson Creek	Osceola National Forest	0.07	Miller
Swift Creek	Occidental	<0.3	Resource Document
Suwannee River	Occidental	0.8	Resource Document
Roaring Creek	Occidental	<0.2	Resource Document
Hunter Creek	Occidental	0.3	Resource Document
Rocky Creek	Occidental	<0.3	Resource Document
Camp Branch	Occidental	<0.4	Resource Document

Table 2.9-5 Summary of Radium-226 Data in Central Florida Aquifers

Area Description	Water Table No.	Water Table pCi/l*	Upper Floridan No.	Upper Floridan pCi/l	Lower Floridan No.	Lower Floridan pCi/l
Unmined Mineralized	23	0.17	5	2.30	24	2.0
Mined Mineralized	12	0.55	10	1.61	6	1.96
Nonmineralized (Control	NO DATA		3	5.1	14	1.4

Source: After Kaufmann and Bliss, 1977.

* All data are geometric means of author's preferred data.

Note: Drinking water standard for total radium is 5 pCi/l.

The Osceola study (Miller, 1977) grouped wells by the geological strata from which water was drawn (see Table 2.9-6). Note that the highest average for either measure of radioactivity was located in the last unit of the Hawthorn formation. The data for the first four units appear to follow the pattern observed in the gamma logs.

2.9.1.6 Summary

Baseline conditions at the proposed site are as follows:

Gamma Radiation - Approximately 5 µR/hr over unaltered lands: typical Florida background ranges from 4.7 to 6.3 µR/hr.

Subsurface Radioactivity - Gamma logs show highest levels at the top of the matrix, some continued activity through the Hawthorn with secondary high spikes.

- Uranium and radium measurements confirm highest activities either just above or in top of matrix.

Matrix radioactivity - Radium approximately 8 pCi/g or 20 percent of that observed in west central Florida.

Radon Flux at Soil Surface - Extremely limited data indicating 0.1 pCi/m^2 sec. Data on unaltered land in Polk County averages 0.3 pCi/m^2 sec.

Radon Progeny in Structures - No measurements available, however, the lower subsurface radioactivity at Occidental should yield lower WL than observed in west central Florida.

Surface Water Radioactivity - Radium-226 between <0.2 to 2.9 and normally less than 1 pCi/l.

Groundwater Radioactivity - Radium-226 between <0.1 to 5 and normally less than 2 pCi/l, concentration appears to be related to depth and therefore radium in the immediate media. Poor water quality especially high Na$^+$ (or Cl$^-$) may enhance radium content.

Table 2.9-6 Summary of Gross Alpha and Radium-226 Data from the Groundwater Study in the Osceola National Forest

	Radioactivity, pCi/l					
	Gross Alpha			Radium-226		
Description	Avg.*	(Range)	No.	Avg.*	(Range)	No.
Superficial Aquifer						
Post Miocene Sand Unit	1.3	(<0.8 - 2.3)	3		(<0.1 -<0.01)	2
Hawthorn Member "A"	4.4	(<0.3 - 6.4)	3		(<0.1 - 0.7)	2
Hawthorn Continuing Unit						
Member "C"	9.0	(<3.5 -23.0)	6	0.9	(0.5 - 1.1)	4
Member "E"	26.0	(-)	1	2.2	(-)	1
Floridan Aquifer	13.0	(<3.5 -43.0)	10	1.8	(0.6 - 5.2)	7

* "Less than" values averaged as "equal to" values

Source: After Miller, 1971.

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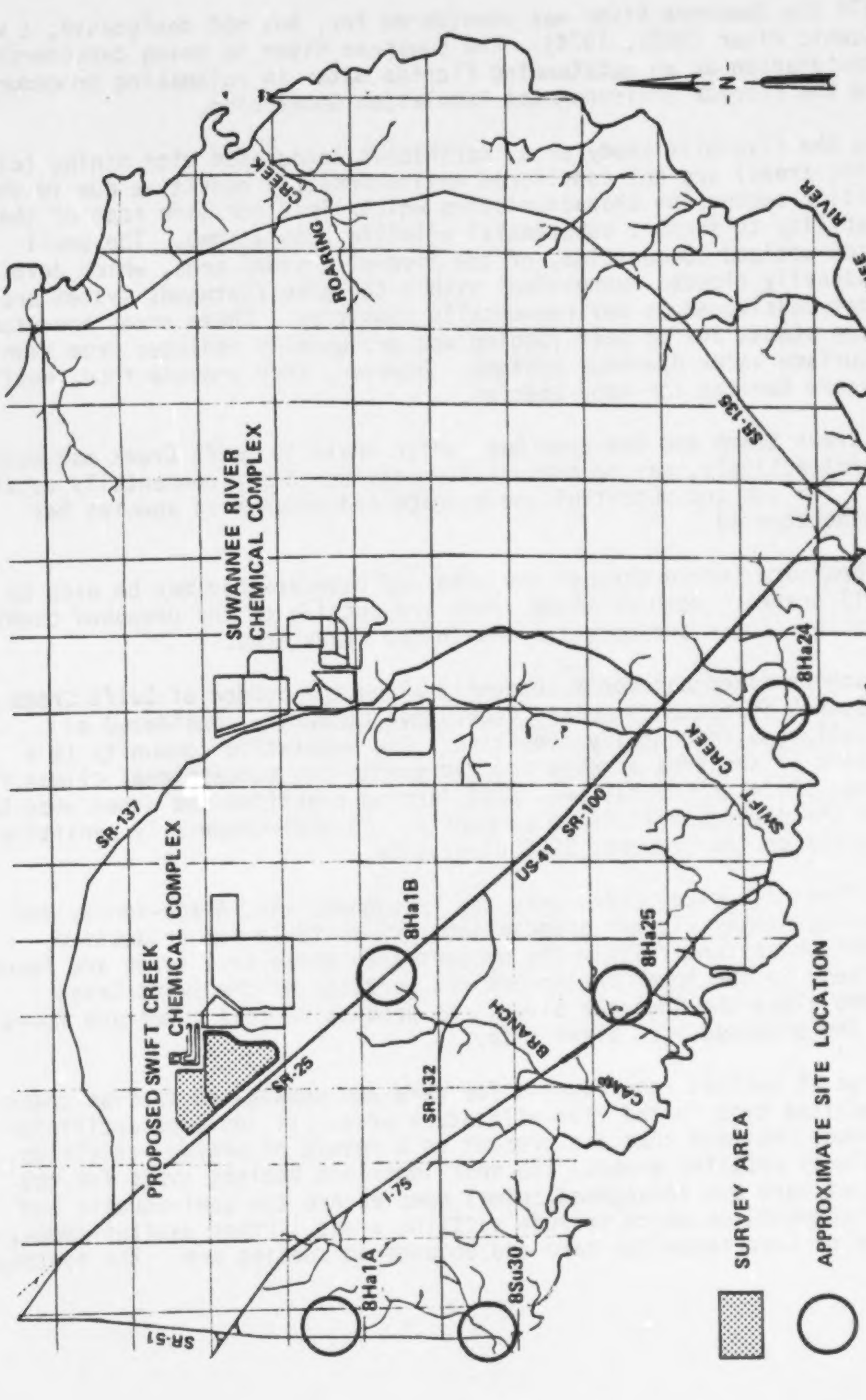
2.10 CULTURAL RESOURCE ASSESSMENT

In accordance with federal mandates implemented by 36 C.F.R. 800, "Procedures for the Protection of Historic and Cultural Properties," an archaeological and historical study was undertaken to assess impact of the proposed project upon cultural resources. Based upon a determination by EPA, the project area was limited to land to be occupied by the proposed chemical plant and associated ponds. The archaeological field survey covered approximately 1000 acres as shown of Figure 2.10-1. The historical documentary study concerned 3 square miles specifically, as well as the Suwannee River and regional phosphate industry in general. Details of both project components are presented in the Resource Document.

Five archaeological sites were recorded in the Florida Master Site File as being within 6 miles of the survey tract. A field survey of the highly disturbed tract revealed no evidence of aboriginal occupation. Historical research utilizing published historical sources, travelers' accounts, federal, state, and local property records and early maps revealed no sites of significance. Lumber and turpentine have been the primary resources in the project area, and deed records provide ample evidence of their exploitation. Camp's Still, a turpentine still and community occupied between 1900 and 1930, is situated just outside the southern property boundary. Several shacks remain standing but the property is not considered eligible for inclusion in the National Register of Historic Places.

By letter of January 26, 1978, the Florida Deputy State Historic Preservation Officer has concurred in a determination of no effect.


PROPOSED SWIFT CREEK CHEMICAL COMPLEX
SUWANNEE RIVER CHEMICAL COMPLEX
SR-137
SR-25
SR-132
I-75
US41
SR-100
SR-135
SR-51
ROARING CREEK
SUWANNEE RIVER
SWIFT CREEK
CAMP BRANCH
8Ha1A
8Su30
8Ha1B
8Ha25
8Ha24
N
0 5000 10000
FEET
SURVEY AREA
APPROXIMATE SITE LOCATION

CULTURAL RESOURCE SURVEY – OCCIDENTAL CHEMICAL COMPANY

FIGURE 2.10-1

2.11 ENVIRONMENTALLY SENSITIVE AREAS

In 1974 the Suwannee River was considered for, but not designated, a wild and scenic river (USDI, 1974). The Suwannee River is being considered for designation as an outstanding Florida water in rulemaking procedures before the Florida Environmental Regulation Commission.

Within the five-mile study area, marshlands associated with mining (clay settling areas) are not considered environmentally sensitive due to the vegetation succession characteristics which limit the life span of their availability to support substantial wildlife populations. The small forested wetland communities, of the five-mile study area, which develop in seasonally flooded depressions within the pine flatwoods system are also not considered as environmentally sensitive. These areas are usually in young stands due to past logging and are usually isolated from significant surface water drainage systems. However, they provide food, nesting and escape habitat for many species.

Swift Creek Swamp and Beehaven Bay, which drain to Swift Creek and Rocky Creek respectively, may be potentially considered environmentally sensitive areas. The use and potential use by rare and endangered species has been demonstrated.

Black bear are hunted through the area and Beehaven Bay may be used by Sandhill cranes. Both of these areas are outside of the proposed chemical plant site. There are no estuaries in the study area.

The southern mixed hardwoods community along the border of Swift Creek and Camps Branch is the only upland vegetative community considered as potentially environmentally sensitive. The vegetative community is a small part of the area acreage and represents the successional climax for the area. Forestry operations, past farming practices and other uses have limited the development of the community. No environmentally sensitive areas occur on the proposed SCCC plant site.

In the five-mile study area, only the Arredondo, var. Alaga-Kenney and the Chipley-Albany-Plummer associations are suitable for productive croplands or pasture. Within the project area these soil types are found exclusively in the lower better drained portions of the Swift Creek basin and along the Suwannee River. No productive soil types are found within the proposed SCCC plant site.

The range of habitat requirements for rare and endangered species spans every habitat type in the five-mile study area. It includes artificial or man-made habitats that are present as a result of mining activities, particularly settling areas. The most important habitat types for the support of rare and endangered animal species are the semi-aquatic and aquatic communities which include settling areas. Other habitat types, in order of importance for rare and endangered species are: the southern mixed hardwoods and hardwood swamps, high pinelands, and pine-palmetto flatwoods. The highest priority habitats for rare and endangered plant species are the ecotone or edges of bayheads, cypressheads and mixed hardwood swamps within the pine flatwoods system.

Two species which were considered as potentially occurring on the proposed SCCC site are associated with the cypress dome community; the striped newt (Notophthalmus perstriatus) and Carpenter frog (Rana virgatipes). However, both of these species have only been recently discovered in Florida and their present range terminates east of this area in neighboring Columbia County.

Populations of species at their range terminus are known to undergo sometimes dramatic fluctuations and even extirpation from even slight changes in the nature and/or quality of their habitat or some other ecological requirements. This fluctuation and the degraded nature of the habitat at the proposed SCCC plant site would seem to indicate the unlikelihood of these two species being present.

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SECTION 3.0

ENVIRONMENTAL EFFECTS OF THE PROPOSED NEW SOURCE

3.1 AMBIENT AIR QUALITY WITH THE PROPOSED SOURCES

The impact of sulfur dioxide (SO_2) and particulate matter emissions from existing and proposed sources was determined by air quality modeling as described in Section 2.2.1. The period of time represented by this evaluation is 1979, the year in which the proposed project is to be completed. The impact of fluoride emissions from the proposed facility was determined by qualitatively projecting fluoride effects measured and observed under existing conditions. Occidental is the only source of these pollutants impacting on the study area and Occidental has no current plans for further expansion. For this reason, the air quality projected for 1979 has been assumed to be representative of air quality that will exist over the next 10 years.

The impact of the proposed sources was evaluated by EPA in January, 1978. Prevention of Significant Deterioration and New Source Review approval was granted in February, 1978 (EPA, 1978). This signifies that EPA has reviewed the proposed action and found that it will not cause air quality standards to be violated, that it will not cause air quality to be significantly degraded, and that SO_2 and particulate matter emissions from the proposed sources will satisfy New Source Performance Standards or Best Available Control Technology.

The county-wide emission burdens of CO, NO_x and hydrocarbons were projected through 1990.

3.1.1 AIR EMISSIONS FROM PROPOSED SOURCES

The air pollutants emitted from the proposed sources in significant quantities are SO_2, particulate matter and fluorides. The SO_2 and particulate matter will be emitted from point sources in quantities readily estimated. Fluorides will be emitted from the phosphoric acid plant and superphosphoric acid plants in readily estimated quantities and from cooling water and gypsum ponds at rates estimated between 0.1 and 10 pounds per acre per day (EPA, undated).

3.1.1.1 Sulfur Dioxide Emissions from Proposed Sources

Sulfur dioxide from the proposed sources will be emitted from the two sulfuric acid plants, the auxiliary boiler associated with the sulfuric acid plants and from the heaters associated with the four superphosphoric acid plants. These emission rates will be limited by New Source Performance Standards and Best Available Control Technology (BACT).

The annual average and short term emission rates of SO_2 from these sources are listed in Table 3.1-1. The design height for the sulfuric

Table 3.1-1. Sulfur Dioxide Emission Data for Proposed Sources for Occidental Chemical Company, White Springs, Florida

Source	Emission Rate		Stack Data				Source Location	
	Annual (Tons/Day)	Maximum (gr/sec)	Height (m)	Temp. (°K)	Velocity (m/sec)	Dia. (m)	X Cord. (km)	Y Cord. (km)
SPA Heaters (SRCC)	1.33	15.5	30.5	468.0	11.8	2.29	28.90	68.90
SPA Heaters (SCCC)	1.33	15.5	15.3	468.0	11.8	2.29	21.10	69.85
Sulfuric Acid E	3.60	42.0	61.0	356.0	30.6	1.83	20.95	69.82
Sulfuric Acid F	3.60	42.0	61.0	356.0	30.6	1.83	20.90	69.70
Aux Boiler (Sulfuric Acid)	1.23	12.9	15.3	468.0	9.5	2.32	20.90	69.75

acid plant stacks is 200 feet. "Good Engineering Practice" for these stack heights, in accordance with the Clean Air Act Amendments of 1977, is 125 feet. The stack height of 125 feet (38 meters) was used for all air quality modeling.

3.1.1.2 Particulate Matter Emissions from Proposed Sources

Particulate matter from the proposed sources will result from acid mist emissions from the sulfuric acid plants and particulate matter emissions from fuel fired boilers and the phosphoric acid plant complex. These emissions are summarized in Table 3.1-2.

3.1.1.3 Fluoride Emission from Proposed Sources

Fluorides from the proposed sources will result from fluoride emissions from the phosphoric acid plant, the superphosphoric acid plants and associated acid clarification facilities. The fluoride emissions from these sources will be limited by New Source Performance Standards or best available control technology. These emissions will total 0.08 pounds of fluoride per ton to P_2O_5 plant capacity or 112 pounds of fluoride per day. The emissions from the cooling water and gypsum ponds will be proportional to the surface area of the ponds.

3.1.2 CALCULATED SULFUR DIOXIDE LEVELS WITH PROPOSED SOURCES

Ambient SO_2 levels were calculated for the annual average, 24-hour and 3-hour periods using procedures described in Section 2.2.1.

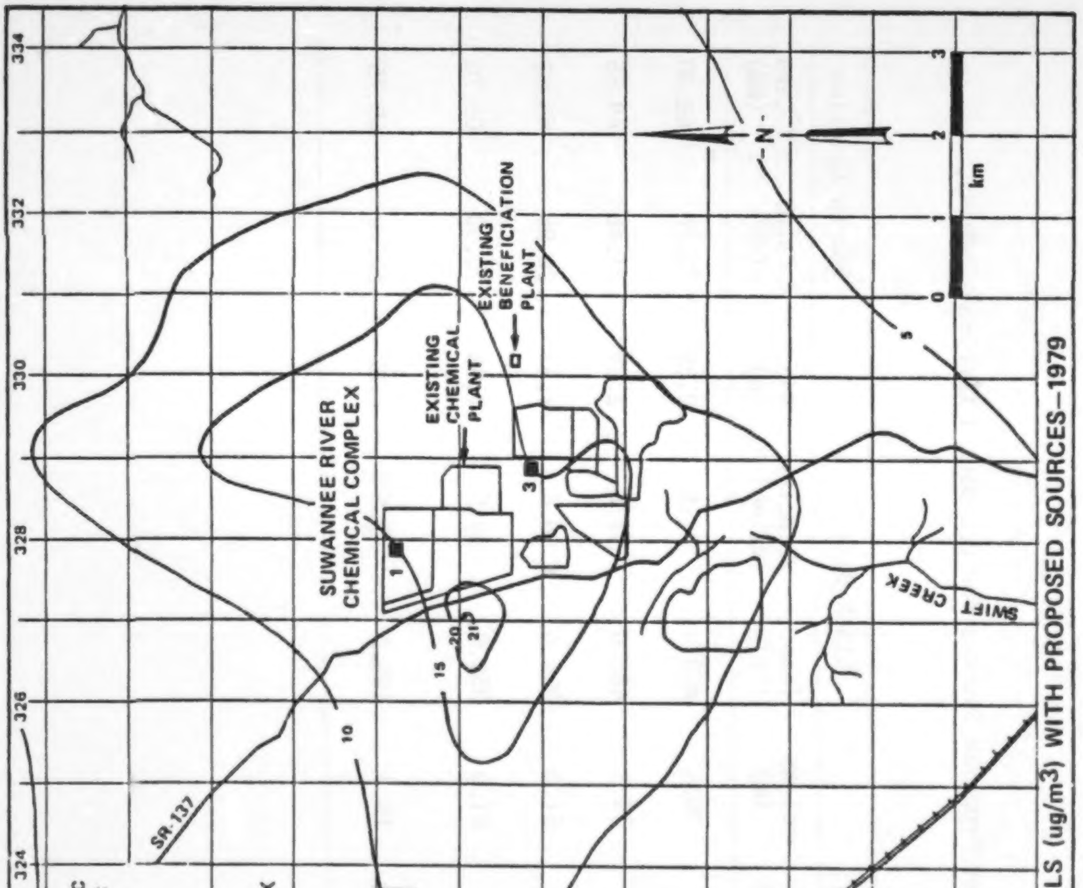
Isopleths of the annual average SO_2 concentrations for the 1979 period are presented in Figure 3.1-1. The data in this figure are summarized in Table 3.1-3. The calculated SO_2 levels for the 24-hour and 3-hour periods are also presented in Figure 3.1-1 and are summarized in Table 3.1-3.

In reviewing these data and comparing them with the 1977-78 period, it will be noted that there are only slight increases in the calculated SO_2 levels caused by the proposed Phase II sources. The reason for this is that these Phase II sources are to be located 7.5 kilometers west of the existing chemical complex at the Suwannee River Chemical Complex.

The maximum calculated annual SO_2 levels for 1979 is 21 micrograms per cubic meter. This compares with a maximum annual SO_2 level of 20 micrograms per cubic meter for the 1977-78 period. These levels compare with a federal standard, established to protect human health, of 80 $\mu g/m^3$, and a state standard of 60 µg/m3. The state standard, equivalent to the national secondary standard, was set to protect human welfare, i.e. materials and vegetation.

3.1-2. Particulate Matter Emission Data for Proposed Sources for Occidental Chemical Company, White Springs, Florida

	Emission Rate		Stack Data				Source Location	
Source	Annual (Tons/Day)	Maximum (gr/sec)	Height (m)	Temp. (°K)	Velocity (m/sec)	Dia. (m)	X Cord. (km)	Y Cord. (km)
SPA Heaters (SRCC)	0.005	0.06	30.5	468.0	11.8	2.29	28.90	68.90
SPA Heaters (SCCC)	0.005	0.06	15.3	468.0	11.8	2.29	21.10	69.85
Sulfuric Acid E	0.135	1.58	61.0	356.0	30.6	1.83	20.95	69.82
Sulfuric Acid F	0.135	1.58	61.0	356.0	30.6	1.83	20.90	69.70
Aux Boiler (Sulfuric Acid)	0.013	0.53	15.3	468.0	9.5	2.32	20.90	69.75


■ 1 – POINT OF MAXIMUM 24 HOUR SO_2 IMPACT, SRCC
■ 2 – POINT OF MAXIMUM 24 HOUR SO_2 IMPACT, SCCC
■ 3 – POINT OF MAXIMUM 3 HOUR SO_2 IMPACT, SRCC
■ 4 – POINT OF MAXIMUM 3 HOUR SO_2 IMPACT, SCCC
SWIFT CREEK CHEMICAL COMPLEX
PROPOSED CHEMICAL PLANT
EXISTING BENEFICATION PLANT
SUWANNEE RIVER CHEMICAL COMPLEX
EXISTING CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
SR-137
SR-25
SR-100
US-41
SR-132
I-75
SWIFT CREEK
CAMP BRANCH
SUWANNEE RIVER
5
10
15
20
21
5
5
N
0
1
2
3
km
318
320
322
324
326
328
330
332
334
3374
3372
3370
3368
3366
3364
3362

CALCULATED SO_2 LEVELS (ug/m^3) WITH PROPOSED SOURCES–1979

FIGURE 3.1-1

Table 3.1-3. Summary of Maximum Calculated Ambient SO_2 Levels from Proposed and Existing Sources for Occidental Chemical Company, Hamilton County, Florida

Averaging Time	Sulfur Dioxide Air Quality Standard		Site: Suwannee River Chemical Complex		Site: Swift Creek Chemical Complex	
	State	Federal	1977-78	1979	1977-78	1979
Annual	60(1)	80(2)	20	21	7	8
24-Hour	260(1)	365(2)	254	259	98	147
3-Hour	1300(1)	1300(1)	1212	1224	35	281

(1) Equivalent to the National Secondary Air Quality Standard

(2) National Primary Air Quality Standard

Note: All values in micrograms per cubic meter.

The maximum calculated 24-hour SO_2 concentration in the area for the 1979 period is 259 micrograms per cubic meter compared with a level of 254 micrograms per cubic meter in 1977-78. This occurs northwest of the existing chemical complex on Occidental property. The maximum 24-hour SO_2 concentration predicted at the Swift Creek site is 147 micrograms per cubic meter, an increase of 49 micrograms per cubic meter over the 1977-78 level. These levels are below the primary and secondary air quality standards of 365 $\mu mg/m^3$ and 260 $\mu g/m^3$, respectively.

The highest 3-hour SO_2 level calculated for the Swift Creek site is 281 micrograms per cubic meter. This compares with a level of 35 micrograms per cubic meter in 1977-78. At the existing chemical complex the highest 3-hour SO_2 level was calculated to be 1224 micrograms per cubic meter. In 1977-78 the level was 1212 micrograms per cubic meter. These calculated levels compare with 1300 $\mu g/m^3$; the national primary air quality standard. There is no 3-hour standard for SO_2.

3.1.3 CALCULATED TOTAL SUSPENDED PARTICULATE MATTER LEVELS WITH PROPOSED SOURCES

Ambient TSP levels were calculated for the 1979 period using air quality modeling techniques described in section 2.2.1. For the 1979 period, the annual average and 24-hour TSP levels were calculated, the latter being calculated for several receptors.

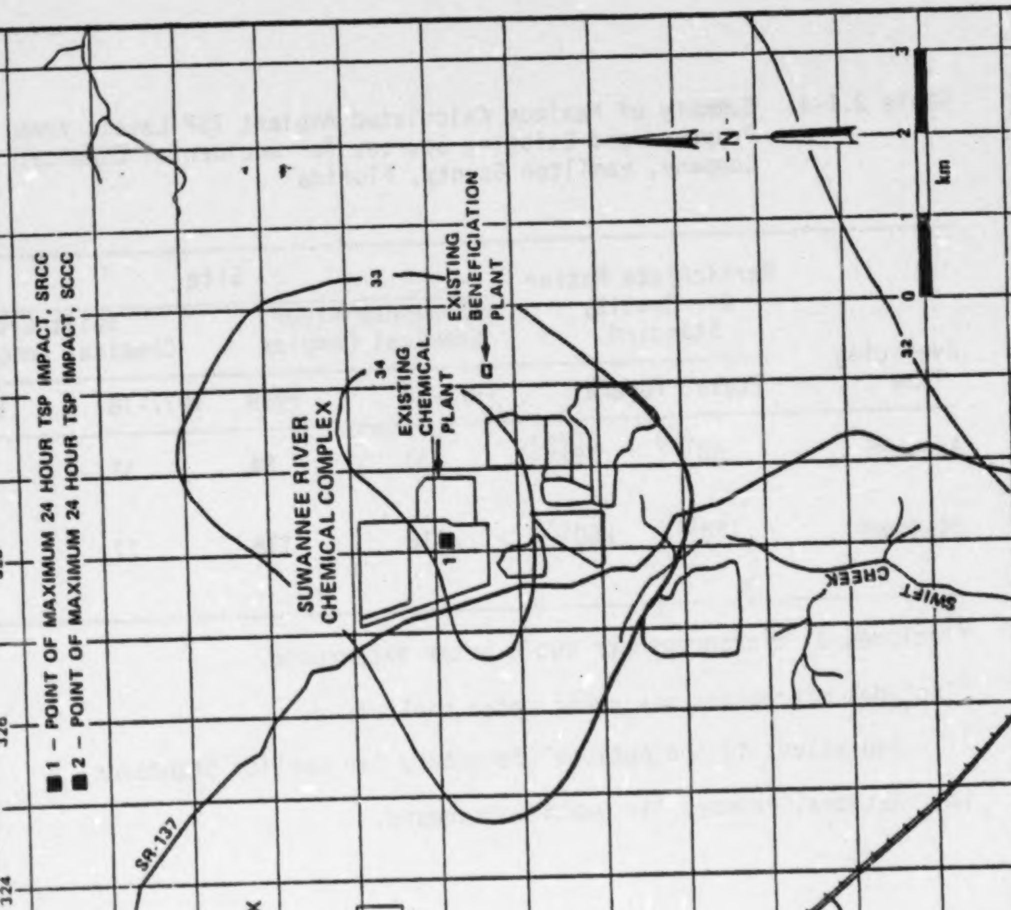
The annual average and 24-hour average TSP levels for 1979 are presented in Figure 3.1-2. These data are summarized in Table 3.1-4.

These data show that in 1979 the highest average annual TSP level predicted for the area is only 3 micrograms per cubic meter above the background level of 31 micrograms per cubic meter. This is the same level that was predicted for the site during the 1977-78 period. The highest annual TSP level predicted for the Swift Creek site in 1979 is 32 micrograms per cubic meter.

It will be noted that, as in 1979, the highest calculated 24-hour average TSP level occurs just west of the existing chemical complex. This level is calculated to be 116 micrograms per cubic meter including 61 micrograms per cubic meter of background particulate matter level. The same level was calculated for the 1977-78 period.

At the Swift Creek site, the calculated 24-hour TSP level for the 1979 period is 78 micrograms per cubic meter. This includes 61 micrograms per cubic meter of background particulate matter level and is only 1 microgram per cubic meter greater than the level calculated for the 1977-78 period.

The air quality standards that these calculated levels compare with are the National primary annual and 24-hour standards of 75 $\mu g/m^3$ and 260 $\mu g/m^3$, respectively; and the national secondary annual and 24-hour standards of 60 $\mu g/m^3$ and 150 $\mu g/m^3$, respectively. The calculated TSP levels around the Occidental site are well below these standards.


■1 – POINT OF MAXIMUM 24 HOUR TSP IMPACT, SRCC
■2 – POINT OF MAXIMUM 24 HOUR TSP IMPACT, SCCC
SUWANNEE RIVER CHEMICAL COMPLEX
EXISTING CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
PROPOSED SWIFT CREEK CHEMICAL COMPLEX
PROPOSED CHEMICAL PLANT
EXISTING BENEFICIATION PLANT
1
2
32
33
34
32
32
-N-
0
1
2
3
km
SR-137
SR-25
SR-100
US-41
SR-132
I-75
SWIFT CREEK
CAMP BRANCH
SUWANNEE RIVER
61
318
320
322
324
326
328
330
332
334
3362
3364
3366
3368
3370
3372
3374

CALCULATED TOTAL SUSPENDED PARTICULATE MATTER LEVELS (ug/m3) WITH PROPOSED SOURCES–1979

FIGURE 3.1-2

Table 3.1-4. Summary of Maximum Calculated Ambient TSP Levels from Proposed and Existing Sources for Occidental Chemical Company, Hamilton County, Florida

Averaging Time	Particulate Matter Air Quality Standard		Site			
			Suwannee River Chemical Complex		Swift Creek Chemical Complex	
	State	Federal	1977-78	1979	1977-78	1979
Annual[a]	60(1)	75(2)	34	34	32	32
24-Hour[b]	150(1)	260(2)	116	116	77	78

[a] Includes 31 micrograms per cubic meter background.

[b] Includes micrograms per cubic meter background.

(1) Equivalent to the National Secondary Air Quality Standards

(2) National Primary Air Quality Standard.

3.1.4 THE ENVIRONMENT WITH PROPOSED FLUORIDE EMISSIONS

Fluoride emissions from phosphate fertilizer plants have been determined to be welfare related; i.e. there is no impact on human health (EPA, 1976).

Fluorides from the proposed facility will result from emissions from the phosphoric acid plant, the four superphosphoric acid plants, the associated acid clarification facility, and the cooling water and gypsum ponds. The emissions from the proposed sources will be 112 pounds of fluoride per day. Emissions from existing sources will be approximately 379 pounds of fluoride per day. Pond emissions are proportional to area and range from 0.1 to 10.0 lb/acre-day (Section 3.2.2.3 of Resource Document).

Existing levels of fluoride in the ambient air over a four-month period range from 0.7 to 1.0 micrograms per cubic meter with 24-hour concentrations ranging to 5.1 micrograms per cubic meter. Fluoride levels in grass during the most critical four months of the year ranged from 16 to 41 ppm total fluoride with the exception of samples collected near cooling water ponds. There is no evidence of fluoride damage to vegetation and no significant effects have been noted in cattle.

Because of the magnitude of fluoride emissions from the proposed sources and the fact that new sources will be located 7.5 kilometers west of the existing sources, it is expected that fluoride levels and fluoride effects from the proposed sources will be less than the observed effects resulting from existing activities.

3.1.5 PROJECTED EMISSION BURDENS OF CO, NOx, AND HYDROCARBONS

The emission burdens of CO, NO_x, and hydrocarbons were calculated for 1979. Since these pollutants result principally from mobile sources, sources which will increase in time, the emission burdens were also projected to 1990. These data are summarized in Table 3.1-5.

The Occidental contribution to the CO burden is 1.0 percent in 1978. It increases to 1.8 percent in 1979 and decreases to 1.5 percent in 1990.

The proposed sources will contribute NO_x as a result of fuel combustion. These will increase the 1978 Occidental contribution to the NO_x burden (42 percent) to 56 percent in 1979. This contribution will then decrease to 51 percent in 1990.

Hydrocarbon emissions result primarily from automotive sources. In 1978, Occidental contributed only 1.7 percent of the hydrocarbons emitted in Hamilton County. This will increase to 3.0 percent in 1979 and decrease to 2.5 percent in 1990.

The county-wide emission of these pollutants is currently at a low level. The increase resulting from the proposed expansion will be small and the incremental impact will be insignificant.

Table 3.1-5. Projected Emission Burdens of CO, NO_x, and Hydrocarbons for Hamilton County, Florida

Period	Source	Pollutant (tons/year)		
		CO	NO_x	Hydrocarbons
1977-78	Highways	5001	873	635
	Dwellings	1	6	0
	Point Sources	53	640	11
	Total	5055	1519	646
1979	Highways	5151	899	654
	Dwellings	1	6	0
	Point Sources	96	1154	20
	Total	5248	2059	674
1990	Highways	6201	1082	787
	Dwellings	1	9	1
	Point Sources	96	1154	20
	Total	6298	2245	808

3.1.6 NOISE LEVEL IMPACT/CONSTRUCTION

Fifteen months are anticipated for completion of construction of the proposed complex. Construction activities and required equipment were identified to provide a basis for prediction of construction noise level impact. Locally high noise levels were predicted near the construction site, with values up to 85 dB_A at 100 feet from the noise source. Since construction will be restricted to daytime hours, the average day-night noise levels due to construction will have zero noise level impact at the nearest off-site residence. Based on U.S. EPA Report 550/9-74-004 (1974), an L_{dn} of 55 dB_A is considered a maximum requisite noise level to protect public health and welfare with an adequate margin of safety. The maximum distance from the proposed site to the contour of L_{dn} 55 dB_A was 5000 feet, an impact on-site of 15 dB_A. However, the distance from the L_{dn} of 55 dB_A contour to the nearest off-site residence was 7000 feet and the L_{dn} at the nearest residence was predicted as 40 dB_A, equal to the baseline noise level.

3.1.7 NOISE LEVEL IMPACT/OPERATION

The L_{dn} values predicted for the essentially continuous operation of the proposed complex are indicated on a map of the proposed site (Figure 3.1-4 of Resource Document). The configuration of the predicted contours is influenced by the characteristics of noise emission from the individual operation in the complex and by obstructions which attenuate noise propagation. Directionality of noise from the sulfuric acid plants in the complex lead to a prediction of an L_{dn} of 55 dB_A contour extending to a distance of near 8000 feet from the boundary of the proposed complex. Nevertheless, the distance from the L_{dn} of 55 dB_A contour to the closest offsite residence is also 8000 feet and the noise level impact at that distance is predicted to be zero.

LIST OF REFERENCES
(Section 3.1)

EPA (Undated), "Evaluation of Emissions and Control Techniques for Reducing Fluoride Emissions from Gypsum Ponds in the Phosphoric Acid Industry"; U.S. Environmental Protection Agency, U.S. Chemical Processes Section, IERL, Contract 68-02-1330, Task No. 3, Research Triangle Park, North Carolina.

EPA (1974), "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety"; Office of Noise Abatement and Control, U.S. Environmental Protection Agency, EPA Report No. 550/9-74-004, Arlington, Virginia, March, 1974.

EPA (1976), "Final Guideline Document: Control of Fluoride Emissions from Existing Phosphate Fertilizer Plants", Office of Air Quality Planning and Standards, U.S. EPA, Research Triangle Park, N.C., November, 1976.

EPA (1978), "Letter from John C. White, Regional Administrator, to Mr. W.W. Atwood, Occidental Chemical Company, Granting PSD Approval - Dated February 27, 1978".

3.2 LAND AND WATER RESOURCES

3.2.1 TOPOGRAPHY AND DRAINAGE BASINS

The proposed Swift Creek Chemical Complex is located wholly in the Swift Creek drainage basin. Therefore, alterations to the original topography within the proposed boundaries of the chemical complex will not result in an alteration of the drainage basin divides.

The proposed gypsum stack-cooling pond complex will, however, occlude certain areas from natural drainage to Swift Creek. This will amount to approximately 550 to 600 acres or two percent of the 42 square mile drainage basin of Swift Creek at its point of confluence with the Suwannee River.

Significant alterations to the original relatively flat topography will occur as the gypsum stack reaches maturity. The gypsum stack is expected to reach a height from 60 feet to 100 feet above natural grade. This would impact an area of about 350 acres. In addition, surface water bodies would increase as a result of the cooling pond which would cover approximately 200-240 acres.

As described in Section 5.2.3.3, reclamation of the gypsum stack prior to abandonment could consist of flattening its slopes and incorporating a clayey soil cover that will be grassed.

3.2.2 GEOLOGY

Mining operations at the site of the proposed cooling pond - gypsum stack chemical complex will alter the natural stratigraphy of the surficial sediments to a maximum depth of about 55 feet, by displacement of the overburden and removal of the ore matrix. The impact of the chemical plant is to dispose of gypsum in mined-out pits created within the proposed area of the stack, an area of up to 350 acres. Neither activity will adversely affect the integrity of the primary Hawthorn confining bed and the underlying Floridan Aquifer limestone.

3.2.3 SOILS

3.2.3.1 Erosion Control

During construction of the plant site and the gypsum stack-cooling pond complex, several areas, not yet disturbed by mining activities, will be cleared of natural vegetation. The building, pavement, and storage areas will be grubbed only as necessary prior to construction. Erosion will be minor (less than 2 tons per acre) and all sediment will be collected in ditches surrounding the plant site.

The base of the embankment and the borrow areas will be grubbed only as required for the section under construction. The borrow areas are not a source of erosion because they will be excavated immediately after grubbing. Some erosion of the earth embankments is expected during construction. Runoff from the embankments will be collected and clarified before it is permitted to enter surface water courses, with further clarification occurring at Eagle Lake prior to discharge into Swift Creek.

Runoff from exposed areas will be collected in perimeter ditches and in adjacent mine pits and will be clarified before it is released from the property. Soil eroded from spoil piles and from the unprotected slopes of the embankments prior to the establishment of a good grass cover will also be collected in ditches and mining pits to meet state water quality standards.

3.2.3.2 Dust Potential

Although embedded dust particles are not directly erodible by the wind, they can be set into motion by the bombarding effect of moving sand particles and by moving vehicles or animals. In their natural state, the surficial soils have no real dust potential and, because the wind velocity is seldom strong enough to put the sand grains in motion, the surficial soils in grubbed areas have a low dust potential except when subjected to heavy construction traffic. Even then, the dust potential is only moderate because of the small percentage of dust-sized particles and the limited acreage uncovered at any one time. Nevertheless, when dusting becomes noticeable, the heavily trafficked areas are generally wetted down with water trucks to minimize maintenance expense of the construction equipment.

The roads within the chemical plant complex will be paved to prevent dusting. Other areas disturbed during construction will be grassed. Thus, the dust potential will be practically eliminated and will revert to natural conditions.

3.2.3.3 Land Use and Gypsum Stack Retirement

Existing soils at the site of the proposed chemical complex are nearly level and poorly drained. The proposed gypsum stack - cooling pond complex is totally located within the Leon-Mascotte-Rutlege Association which, overall, has a low potential for crop production, but a high potential for improved pasture with proper water management. Its capability for pine woodlands ranges from low to moderate. On-site, these soils have traditionally been used for pine timber or pulpwood production. Since the area affected by the chemical complex is limited to approximately 600 acres, removal of this land from potential agricultural or silvicultural usage should not have a major impact because the existing soils require special conservation practices and careful management due to poor drainage and high water table levels.

Potential impacts from the gypsum stack after retirement would include some dusting from climatologic drying and wetting cycles, and leaching as rain water percolates through the stack. Mitigative measures to reduce and/or eliminate the potential impacts of a retired gypsum stack are discussed in Section 5.2.3.3.

3.2.4 SURFACE WATER QUANTITY

3.2.4.1 Average Flow of Swift Creek

The proposed gypsum stack-cooling pond complex would occlude approximately 550 to 600 acres from natural drainage. This results in a reduction of the Swift Creek flows by about 0.5 cfs over a long-term period, which amounts to less than one percent of the flow in Swift Creek at its point of confluence with the Suwannee River.

Nonprocess water discharged to Swift Creek from full development of the Swift Creek Chemical Complex will average approximately 2.2 cfs. The effect of occlusion of the gypsum stack and cooling pond from natural drainage (0.5 cfs decrease) and discharge of nonprocess water (2.2 cfs increase) will yield an average net increase in flow of about 1.7 cfs during the active life of the plant. The additional flow will increase the current flow of Swift Creek at its point of confluence with the Suwannee River by about 3 percent resulting in no measurable increase in scour.

3.2.4.2 Low Flows of Swift Creek

Base flow to Swift Creek during periods of low flow will not be reduced by the proposed facility. The storage provided by various existing ponded areas, such as Eagle Lake, in the mining development, and nonprocess water discharges from the proposed plant could be used to augment low flows. On the average, based on a mass balance of stream loading at White Springs and Suwannee Springs, the existing record shows that during periods of low flow, discharges from the Occidental property have been approximately 40 percent and 27 percent of the long-term average discharge for the M(7,2)* and M(7,10)* flows, respectively. It is likely that the proposed plant will have similar reduced discharges at low flow, increasing these low flows on the average by about 0.6 to 0.9 cfs, respectively. However, the lowest stream flows will be associated with the simultaneous occurrence of a drought and a shutdown of operations. In this event, there will be no impact from the proposed facility on low flow in Swift Creek.

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* M(7,2) -- median annual 7-day low flow, 7-day low to which flows will recede once every two years.
M(7,10) -- 7-day low flow to which flows will recede once in 10 years.

3.2.4.3 Flood Flows of Swift Creek

The gypsum stack-cooling pond complex would somewhat attenuate peak flows in Swift Creek because storm precipitation within the system is stored, at least temporarily, prior to being treated and discharged, if needed. This reduction in peak flows should not, however, be appreciable and will probably be offset by nonprocess discharges.

3.2.4.4 Suwannee River Flows

Changes in the rate of flow caused by the development of Swift Creek Chemical Complex will not be perceptible on measured flows in the Suwannee River because of the relative size of the Suwannee River. The average increase in flow in Swift Creek amounts to less than 0.1 percent of the average Suwannee River flow at its point of confluence with Swift Creek.

3.2.5 GROUNDWATER QUANTITY

3.2.5.1 Surficial Aquifer

The groundwater level in the surficial aquifer will not be significantly affected by the proposed facilities since the water level in the below-ground cooling pond surrounding the gypsum stack would be maintained within a few feet of the ground surface. Seepage from the gypsum stack and above-ground cooling pond will flow to the adjacent below-ground cooling pond because it acts as a sump in the surrounding flat topography. Any potential effect on the groundwater levels in the surficial aquifer would be very localized and confined to the immediate vicinity of the facility. Hence, water availability within the surficial aquifer will not change as a result of the proposed chemical complex.

3.2.5.2 Floridan Aquifer

It is anticipated that 2611 gpm (3.76 MGD) of groundwater will be required during the operation of the proposed chemical plant. This water will be supplied from a single well of 7000 gpm design capacity located at the plant site and tapping the Floridan Aquifer to a depth of about 800 feet.

The drawdown of the potentiometric surface which would result from pumping the well at 2611 gpm under steady-state conditions was computed to be about 7 feet at a distance of 500 feet away from the well and less than 3.5 feet at 10,000 feet from the well.

The actual decline of the potentiometric surface resulting from the proposed withdrawals would be even lower than estimated above because the natural leakage to the Floridan Aquifer at the outer edge of the zone of influence (e.g., in the Coastal Lowlands along the channel of the Suwannee River) is expected to be larger than that used in the analysis.

The decrease in the potentiometric surface of the Floridan Aquifer would increase the recharge rate (and decrease stream flow). However, the amount of increased recharge (and decreased stream flow) is very small. For example, the existing recharge rate of 1 inch per year would be increased to 1.11 inches per year and 1.04 inches per year at distances of 100 and 10,000 feet from the well, respectively.

The maximum recharge would occur under the gypsum stack when it reaches maturity because of the additional hydraulic head difference created by ponding water on top of the stack. This applied head could reach 100 feet when the stack is mature, at which time the natural recharge rate of 1.0 in/yr would increase to a maximum of 2.3 in/yr. This increased recharge will be supplied from water currently in storage in the Hawthorn confining unit. The impact on groundwater quality is addressed in Section 3.2.7.

3.2.6 SURFACE WATER QUALITY

3.2.6.1 Composition of Discharge from the Proposed Swift Creek Chemical Complex

The SCCC will regularly discharge nonprocess water and rainfall run-off. It will infrequently discharge treated process water.

The recirculating process cooling water system has a negative water balance. However, the seasonal imbalance in rainfall over evaporation may require the treatment and release of process water. The existing Suwannee River Chemical Complex has discharged process water intermittently and for less than 4 to 5 months during the 10-year history of the plant.

Nonprocess water will discharge at approximately 2.2 cfs as an annual average. A stormwater run-off component from the plant site will add 0.2 cfs as an annual average. Thus, the discharge of nonprocess water from the SCCC will be approximately 2.4 cfs as an annual average.

Waters from the proposed complex will be similar in quality to those discharged from the existing Suwannee River Chemical Complex. However, nitrogen levels will be lower since diammonium phosphate will not be produced. Although there will be no source of ammonium at the proposed Swift Creek Chemical Complex other than natural sources such as rainfall and run-off, a conservative value of 1.0 mg N/l has been used to estimate the ammonium content of its nonprocess water. Facility sources of nonprocess water, groundwater and rainfall have much lower concentrations (<0.2 mg N/l).

3.2.6.2 Impact of Nonprocess Water Discharges

Impacts of the proposed complex upon Swift Creek and the Suwannee River are estimated for phosphate, nitrogen, total organic carbon, fluoride and sulfate. Phosphate, nitrogen and carbon were selected for the calculations because they are major nutrients which are normally limiting to aquatic organisms and are most likely to cause problems when present in excess. Fluoride and sulfate were chosen because they are closely related to phosphate processing.

Two impact scenarios were examined. Scenario A considers the average estimated composition of nonprocess water (Table 3.2-1). Scenario B considers that the discharge would have the maximum concentrations of P and F allowable under federal Fertilizer Effluent Guidelines.

Predicted loadings (kg/day) and concentrations (mg/l) were based on a constant 2.4 cfs discharge. Both scenarios considered annual average flow, low flow (M7,2) and very low flow (M7,10) conditions in Swift Creek and the Suwannee River (Tables 3.2-2, 3.2-3 and 3.2-4).

3.2.6.2.1 Phosphates

Swift Creek: For Scenario A, the phosphate concentration will be reduced under all flow conditions except during peak flow when the concentration remains essentially the same (Table 3.2-2). Thus, nonprocess water from the Swift Creek plant could slightly decrease the present phosphate concentration in Swift Creek.

For Scenario B, the largest increase in concentration occurs during very low flow when it increases from 17.7 to 19.3 mg/l, or 9%. With average flow, the concentration increases from 15.9 mg/l to 16.7 mg/l, or 5 percent.

Suwannee River: The impact of increased loading due to the proposed plant is minimal under average flow. For Scenario A, levels will increase from 0.58 to 0.59 mg/l at Suwannee Springs, or approximately 2 percent. Similar increases will occur at Branford and Wilcox (Table 3.2-4).

The largest impact will occur under Scenario B and very low flow in the Suwannee River (Table 3.2-4). Under these conditions, the phosphate levels will increase 1.1 mg/l P over the present levels at Suwannee Springs. At Wilcox, the increase is 0.02 mg/l P. These very small increases (i.e. 0.02 mg/l P) are probably not detectable given the present sampling procedures and analytical methods.

Table 3.2-1 Estimated Concentrations and Mass Loads from Nonprocess Discharges of Proposed Swift Creek Phosphate Plant

Parameter	Estimated Average Concentration (mg/l)	Estimated Mass Loading (kg/day) in 2.4 cfs of Discharge
pH	6.0	--
Total P	11.0	64.6
Ammonium-N	1.0	5.9
Nitrate-N	0.9	5.3
Organic-N	0.5	2.9
Total N	2.4	14.1
TOC	9.3	54.6
Sulfate	250	1470
Fluoride	7.2	42.3
Calcium	58	341
Sodium	65	382
NPDES Permit Limitations:		
Total P	35	206
Fluoride	25	147

Table 3.2-2 Mass Loading and Concentrations at Mouth of Swift Creek Under Present Conditions and with Added Discharge from Swift Creek Chemical Plant Nonprocess Water

PARAMETER	MASS LOADINGS AT AVERAGE FLOW IN kg/day		
	Present Loading*	Predicted Loading With New Source	Percent Change
Total P (Predicted)	2300	2365	2.8
(NPDES Limit)	2300	2506	9.0
Total N	1160	1174	1.2
Fluoride (Predicted)	766	808	5.5
(NPDES Limit)	766	913	19.2
Sulfate	21700	23170	6.7
TOC	2760	2815	2.0
Calcium	6640	6981	5.1
Sodium	4180	4562	9.1

PARAMETER	CONCENTRATIONS FOR VARYING FLOW CONDITIONS IN mg/l							
	Average Flow		M(7,2) Low Flow		M(7,10) Low Flow		5-Year Peak Flow	
	Present	With New Source	Present	With *** New Source	Present	With *** New Source	Present	With New Source
Total P (Predicted)	15.9	15.7	17.4	17.0	17.7	17.2	10.8	10.8
(NPDES Limit)	15.9	16.7	17.4	10.5	17.7	18.9	10.8	10.8
Total N	8.0	7.8	8.9	8.5	9.2	8.7	5.2	5.2
Fluoride (Predicted)	5.3	5.4	5.8	5.9	5.9	6.0	3.7	3.7
(NPDES Limit)	5.3	6.1	5.8	7.0	5.9	7.3	3.7	3.7
Sulfate	157	161	179	183	186	191	69	69.3
TOC	19.1	18.7	16.1	15.2	15.5	15.0	41.4	41.4
Calcium**	46	46.5	--	--	--	--	--	--
Sodium**	29	30.4	--	--	--	--	--	--

*Based on average flow and corresponding regression value for concentration.

**Regression relation between flow and concentrations of these parameters are unavailable at this time.

***Assumes all the non-process discharge will be discharged during periods of low flow. Long-term record indicates discharge during M(7,2) and M(7,10) are 40% and 27% of average discharge, respectively.

Table 3.2-3 Mass Loadings and Concentrations Along the Suwannee River Below Swift Creek Under Present Conditions and with Added Discharge from Swift Creek Chemical Plant Nonprocess Water

MASS LOADINGS IN kg/day AT AVERAGE FLOW

Parameter	Suwannee Springs			Branford			Wilcox		
	Present	With New Source	Percent Change	Present	With New Source	Percent Change	Present	With New Source	Percent Change
Total P (Predicted)	2950	2915	2.3	3340	3405	1.9	3825	3890	1.7
(EPA Guidelines)	2850	3056	7.2	3340	3546	6.2	3825	4031	5.4
Total N	4720	4734	0.3	10000	10014	0.1	12460	12474	0.1
Fluoride (Predicted)	1900	1942	2.2	3920	3962	1.1	5760	5802	0.7
(EPA Guidelines)	1900	2047	7.7	3920	4067	3.8	5760	5907	2.6
Sulfate	50300	51770	2.9	147000	148470	1.0	294000	295470	0.5
TOC	139000	139055	0.04	212000	212055	0.03	267000	267055	0.02

MASS LOADINGS IN kg/day AT M(7,2) LOW FLOW

Parameter	Suwannee Springs			Branford			Wilcox		
	Present	With New Source	Percent Change	Present	With New Source	Percent Change	Present	With New Source	Percent Change
Total P (Predicted)	880	945	7.4	1450	1515	4.5	1870	1935	3.5
(EPA Guidlines)	880	1086	23.4	1450	1656	14.2	1870	2076	11.0
Total N	728	742	1.9	5342	5356	0.3	12430	12440	0.1
Fluoride (Predicted)	194	236	21.6	1230	1272	3.4	2910	2952	1.4
(EPA Guidelines)	194	341	76.0	1230	1377	12.0	2910	3057	5.1
Sulfate	7320	8790	20.0	104000	105470	1.4	279000	280470	0.5
TOC	5990	6045	0.9	39400	39455	0.1	85200	85255	0.1

MASS LOADINGS IN kg/day AT M(7,10) LOW FLOW

Parameter	Suwannee Springs			Branford			Wilcox		
	Present	With New Source	Percent Change	Present	With New Source	Percent Change	Present	With New Source	Percent Change
Total P (Predicted)	618	683	9.5	1110	1175	5.5	1370	1435	4.5
(EPA Guidelines)	618	824	25.0	1110	1316	15.7	1370	1576	13.1
Total N	503	517	2.7	5489	5503	0.25	13500	13514	0.10
Fluoride (Predicted)	98	140	30.0	848	890	4.7	2170	2212	1.9
(EPA Guidelines)	98	245	60.0	848	995	14.8	2170	2317	6.3
Sulfate	4080	5550	26.5	93100	94570	1.6	273000	274470	0.53
TOC	2330	2385	2.3	22100	22155	0.3	52500	52555	0.10

Table 3.2-4 Concentrations Along the Suwannee River Below Swift Creek Under Present Conditions and with Added Discharge from Swift Creek Chemical Nonprocess Water

CONCENTRATIONS IN mg/l FOR VARYING FLOW CONDITIONS FOR SUWANNEE SPRINGS STATION

Parameter	Average Flow		M(7,2) Flow		M(7,10) Flow	
	Present	With New Source	Present	With New Source	Present	With New Source
Total P (Predicted)	.576	.588	2.50	2.60	3.89	4.14
(NPDES Limit)	.576	.620	2.50	3.03	3.89	4.99
Total N	.956	.958	2.06	2.06	3.36	3.32
Fluoride (Predicted)	.386	.394	0.55	0.66	.615	.849
(NPDES Limit)	.386	.415	0.55	0.96	.615	1.48
Sulfate	10.3	10.6	20.8	24.60	25.7	33.7
TOC	28.1	28.1	17.0	16.90	14.6	14.4

CONCENTRATIONS IN mg/l FOR VARYING FLOW CONDITIONS AT BRANFORD

Parameter	Average Flow		M(7,2)		M(7,10)	
	Present	With New Source	Present	With New Source	Present	With New Source
Total P (Predicted)	0.196	.199	.251	.261	.271	.286
(NPDES Limit)	0.196	.209	.251	.286	.271	.321
Total N	0.587	.589	.923	.925	1.28	1.28
Fluoride (Predicted)	0.231	.232	.212	.219	.208	.217
(NPDES Limit)	0.231	.239	.212	.238	.208	.243
Sulfate	8.64	8.72	18.0	18.2	22.8	23.1
TOC	12.5	12.5	6.81	6.81	5.40	5.41

CONCENTRATIONS IN mg/l FOR VARYING FLOW CONDITIONS AT WILCOX

Parameter	Average Flow		M(7,2)		M(7,10)	
	Present	With New Source	Present	With New Source	Present	With New Source
Total P (Predicted)	.157	.159	.154	.159	.152	.159
(NPDES Limit)	.157	.166	.154	.171	.152	.176
Total N	.510	.512	1.02	1.02	1.55	1.55
Fluoride (Predicted)	.236	.238	.239	.243	.241	.246
(NPDES Limit)	.236	.242	.239	.251	.241	.258
Sulfate	12.0	12.1	23.0	23.1	30.3	30.5
TOC	10.9	10.9	7.01	7.01	5.83	5.83

Phosphates are often related to eutrophication of waters since they can be the limiting constituent in such waters. Hutchinson (1957) reported that most natural waters contain from 0.01 to 0.03 mg/l P. At these levels, phosphate are usually limiting to aquatic plants.

If other factors, such as nitrogen, carbon or physical parameters, such as light penetration or mixing, are not limiting and the phosphate level rises above these values, excessive growth of nuisance algae or aquatic plants can occur.

When phosphate concentrations are appreciably above 0.02 to 0.1 mg/l, it probably is seldom limiting. The Suwannee River background concentration is about 0.3 mg/l. Given these conditions, it is quite probable that additional phosphate will not cause eutrophication. Protection is usually warranted for waters with naturally low phosphate concentrations. FDER states in its proposed F.A.C. Ch. 17-3 water quality regulations that "consideration shall be given to the protection from nutrient enrichment of those waters presently containing very low nutrient concentrations; less than 0.3 mg/l total nitrogen or less than 0.04 mg/l total phosphorus." EPA (1976) states a similar opinion in their Quality Criteria for Water in which they only suggest criteria for streams flowing into lakes or reservoirs which may accumulate phosphates.

While phosphate levels in Swift Creek and the Suwannee River are high, it is expected that no environmental effect on the aquatic system will result from increased phosphate levels since all concentrations in the streams are well above levels limiting to aquatic plants. No reported problems attributable to high phosphate levels in the Suwannee River have been located for review.

3.2.6.2.2 Total Nitrogen

Swift Creek: A 2 to 5 percent reduction in total nitrogen concentration will occur in Swift Creek under all flow conditions because no ammonia is planned to be used at the Swift Creek Chemical Complex. At peak flow, the concentration will remain essentially the same (Table 3.2-2).

Suwannee River: Based on background concentrations in deep well and rainwaters, the predicted increase in mass loading of N in Swift Creek is 14 kg/day. This is negligible compared to present loadings: Swift Creek - 1160 kg/day; Suwannee Springs - 4720 kg/day; Branford - 10000 kg/day; and Wilcox - 12460 kg/day.

As with phosphate, increased nitrogen concentrations (Table 3.2-4) should not cause eutrophication problems because they are already above the range of concentrations thought to be limiting to aquatic plants. Other factors, such as light penetration of the highly colored waters, mixing, and stream velocity are probably limiting.

FDER does not regulate the concentration of total nitrogen in water.

3.2.6.2.3 Fluoride

Swift Creek: Under Scenario A, mean fluoride concentrations will increase less than 2 percent under all flow conditions, except during peak flow where the concentration remains essentially the same (Table 3.2-2).

With Scenario B, fluoride concentrations will increase 15 percent for average flow conditions and up to 29 percent for the very low flow case (Table 3.2-2). However, the concentrations will remain below the FDER 10 mg/l limit for fluoride in Class III waters.

Suwannee River: The proposed source will have some impact upon the Suwannee River in either scenario. However, the predicted levels in all cases remain below the FDER limit of 10 mg/l and also below the Class I (drinking water) limit of 1.6 mg/l and should cause no problem.

3.2.6.2.4 Sulfate

The present concentration of sulfate in Swift Creek at average flow is 157 mg/l (Table 3.2-2); the new discharge would increase this to 161 mg/l (2.5 percent). Under very low flow conditions, the concentration is estimated to increase from 186 to 192 mg/l (3.2 percent).

For the Suwannee River at Suwannee Springs, the sulfate concentration at average flow would increase from 10.3 to 10.6 mg/l (3 percent).

At concentration levels less than 250 mg/l, sulfate is not detrimental for domestic use or stock and wildlife watering. Sulfate concentrations up to 200 mg/l are not detrimental for irrigation (McKee and Wolf, 1971). Currently, there are no standards for sulfate in Florida Class III waters; potable waters have a limit of 250 mg/l. The deep wells used by Occidental have sulfate levels of 24 to 145 mg/l.

3.2.6.2.5 Total Organic Carbon

Total Organic Carbon (TOC) is a measure of the concentration of organic matter in water. Relatively high concentrations of TOC occur naturally in the headwaters of Swift Creek and in the Suwannee River as a result of run-off from wetlands and forests. Data in Table 3.2-2 through 3.2-4 show that concentrations of TOC will decrease slightly as a result of the new discharge, although the mass loadings slightly increase. There will be no detectable impact on the TOC level in the receiving waters. There are no state of federal regulations concerning TOC.

3.2.6.3 Impact of Treated Process Water Discharge

Process water will be treated and discharged when pond water levels infringe upon the surge capacity of the cooling pond (see Section 1.4.2.1.7).

To present the maximum impact from treated process water, it was assumed that both the Suwannee River and the proposed Swift Creek plants will be discharging at the same time. The Suwannee River has a treating facility designed to treat at a maximum rate of 3000 GPM, or 6.7 cfs. The proposed Swift Creek plant facility can treat at a maximum rate of 2000 GPM or 4.5 cfs. At worst, the treated water will meet the EPA guidelines of 25 mg/l F and 35 mg/l P as a maximum daily average. Based on a discharge rate of 6.7 cfs and guideline limitations the present SRCC could discharge 575 kg/day of phosphate and 410 kg/day of fluoride during periods of treatment. The SCCC could add 385 kg/day phosphate and 275 kg/day of fluoride in addition to this if it were treating water concurrently at 4.5 cfs and just meeting the EPA guideline limitations.

These predicted concentrations represent the maximum impact anticipated from the discharge of treated process waters (Table 3.2-5). The actual concentrations of phosphate and fluoride discharged have been and should continue to be lower than the permit limitations (Table 1.4-6). The process water impact will be short-term because of the infrequent nature of these discharges. During the 10-year history of the present Suwannee River plant, treated process waters have been discharged for an aggregate of only 4 to 5 months at 1000 GPM.

3.2.6.4 Summary

Minimal changes in concentrations of the chemical parameters of interest are expected in Swift Creek or the Suwannee River as a result of the new discharge. For one parameter, nitrogen, a decrease is predicted.

In all cases, the concentrations are below guideline and/or legal limitations.

Table 3.2-5 Predicted Increases in Phosphate and Fluoride Concentrations in Swift Creek and the Suwannee River due to the Discharge of Treated Process Water from SCCC

Parameter	Baseline Concentration* (mg/l)	Concentration after Addition of Treated Process Water (mg/l)	Increase (mg/l)	Percent Change (%)
		Swift Creek		
Phosphate as P	17.6	18.7	1.1	6.1
Fluoride	7.3	8.4	1.1	15.0
		Suwannee River at Suwannee Springs		
Phosphate as P	0.71	0.79	0.08	11.3
Fluoride	0.47	0.52	0.05	10.6
		Suwannee River at Wilcox		
Phosphate as P	0.18	0.20	0.02	8.7
Fluoride	0.26	0.27	0.01	4.0

*Assumes the following flows - Swift Creek base flow plus SRCC nonprocess water 59 cfs; SRCC treated process water 6.7 cfs; SCCC nonprocess waters 2.4 cfs.

3.2.7 GROUNDWATER QUALITY

3.2.7.1 Characteristics of Process Water

Seepage of process water from the gypsum stack and cooling pond of the proposed plant represents the only significant source of concern regarding possible contamination of groundwater aquifers. Process waters are highly acidic and have very high concentrations of phosphate, fluoride, and sulfate. Other ions such as calcium, sodium, iron, manganese, ammonium, arsenic, and chromium, also have high concentrations compared to ambient levels in ground or surface waters of the region (see Resource Document).

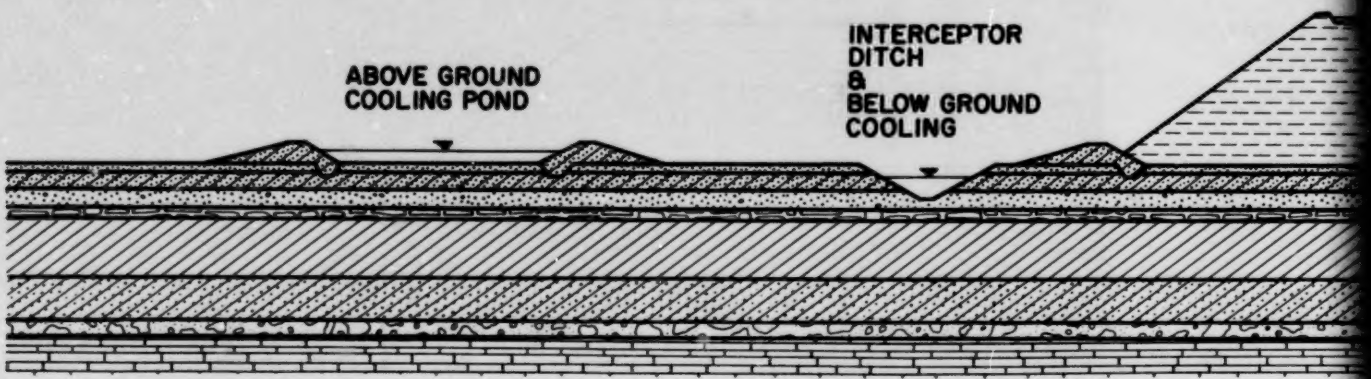
3.2.7.2 Seepage from Proposed Gypsum Stack-Cooling Pond Complex

The proposed gypsum stack and cooling pond will be constructed in stages. At start-up the gypsum stack will be constructed partially within a mined-out area and partially on natural ground (see Figure 3.2-1). Most of the cooling pond will be constructed on natural ground. The remainder of the cooling area will be provided within a deep ditch excavated around the periphery of the gypsum stack to intercept seepage from the stack.

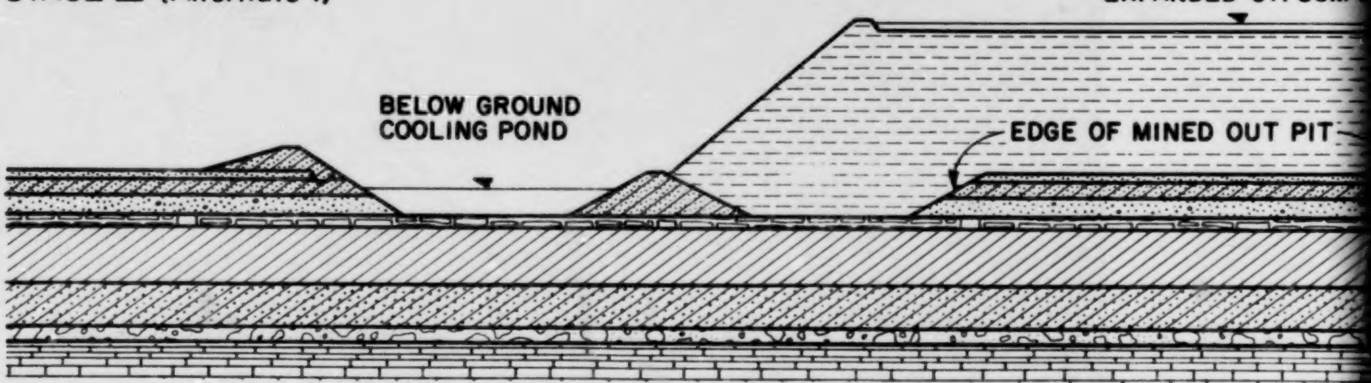
The normal operating level of the belowground cooling area will be maintained within a few feet of the groundwater table. The level will be maintained by controlling the spillway discharge from the aboveground pond and/or by adding water to the system; e.g., non-process water. Although it is anticipated that there will be periods when groundwater seeps into the belowground pond, the system will be designed and operated so that, on the average, the level in the belowground cooling area will be slightly above the groundwater table; i.e., seepage will be from the cooling pond into the surficial aquifer. The reason for operating the cooling pond as described is to prevent groundwater seepage from the surficial aquifer from entering the process water system, where it eventually would have to be treated and discharged to surface waters. (Net seepage from the cooling pond was not included in the water balance calculations discussed in Section 1.4.2.) The impact of seepage from the cooling pond into the surficial aquifer is discussed in Section 3.2.7.4.

Occidental plans to mine the area adjacent to the Stage I gypsum stack and use the mined-out area for a belowground cooling pond and for future expansion of the gypsum stack (see Alternate I, Figure 3.2-1). The

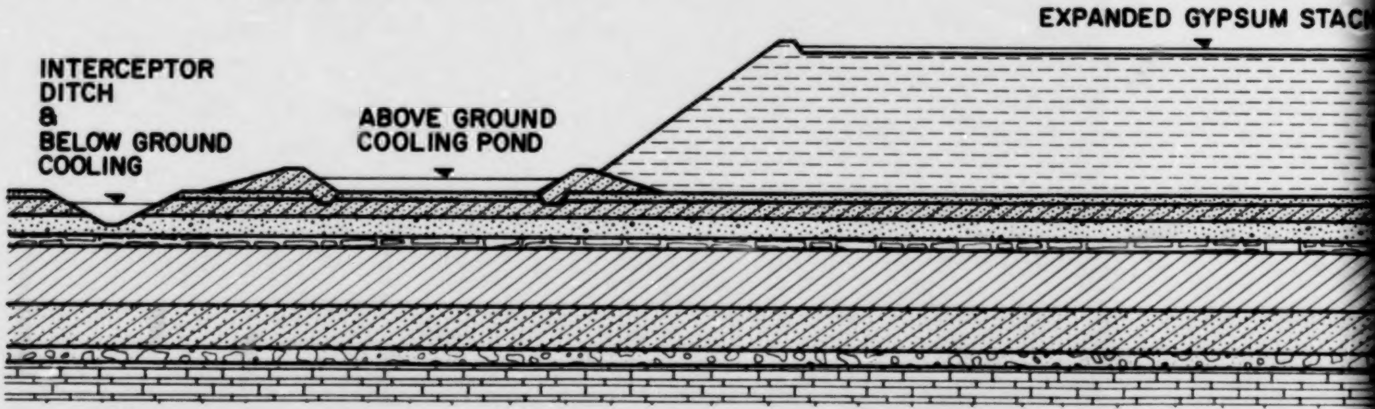
STAGE I


ABOVE GROUND
COOLING POND
INTERCEPTOR
DITCH
&
BELOW GROUND
COOLING

STAGE II (Alternate 1)

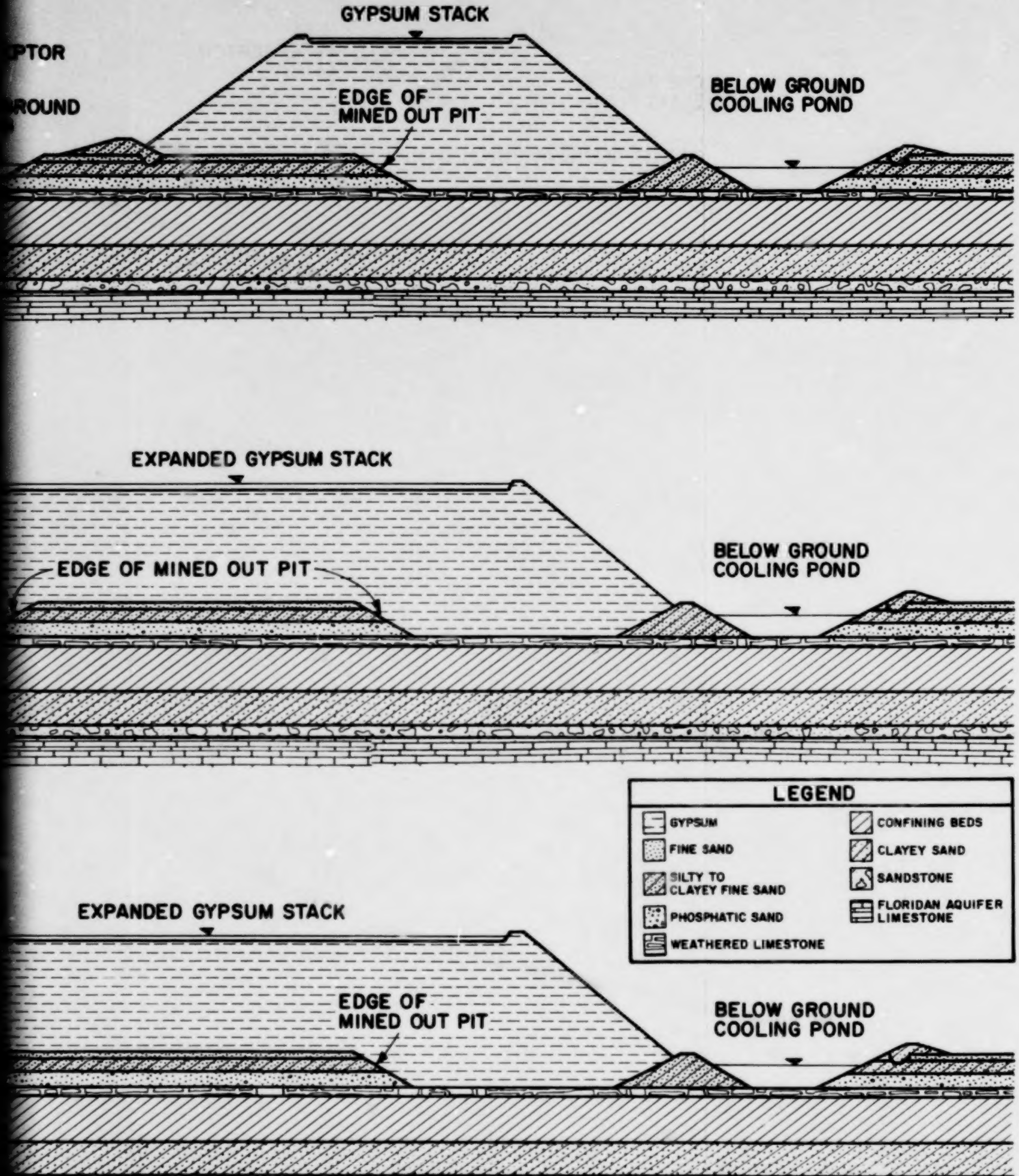

EXPANDED GYPSUM S
BELOW GROUND
COOLING POND
EDGE OF MINED OUT PIT

STAGE II (Alternate 2)


EXPANDED GYPSUM STAC
INTERCEPTOR
DITCH
&
BELOW GROUND
COOLING
ABOVE GROUND
COOLING POND

A

CONCEPTUAL LAYOUT OF P
GYPSUM STACK AND COOLI


GYPSUM STACK
PTOR
ROUND
EDGE OF MINED OUT PIT
BELOW GROUND COOLING POND
EXPANDED GYPSUM STACK
EDGE OF MINED OUT PIT
BELOW GROUND COOLING POND
LEGEND
GYPSUM
FINE SAND
SILTY TO CLAYEY FINE SAND
PHOSPHATIC SAND
WEATHERED LIMESTONE
CONFINING BEDS
CLAYEY SAND
SANDSTONE
FLORIDAN AQUIFER LIMESTONE
EXPANDED GYPSUM STACK
EDGE OF MINED OUT PIT
BELOW GROUND COOLING POND

ONCEPTUAL LAYOUT OF PROPOSED
YPSUM STACK AND COOLING PONDS

B

FIGURE 3.2-1

belowground cooling pond during this later stage in the development of the stack will also be designed and operated to maintain the normal pond level slightly above the groundwater table. The water level will be maintained by controlling the amount of water stored on the gypsum stack and/or by adding water to the system.

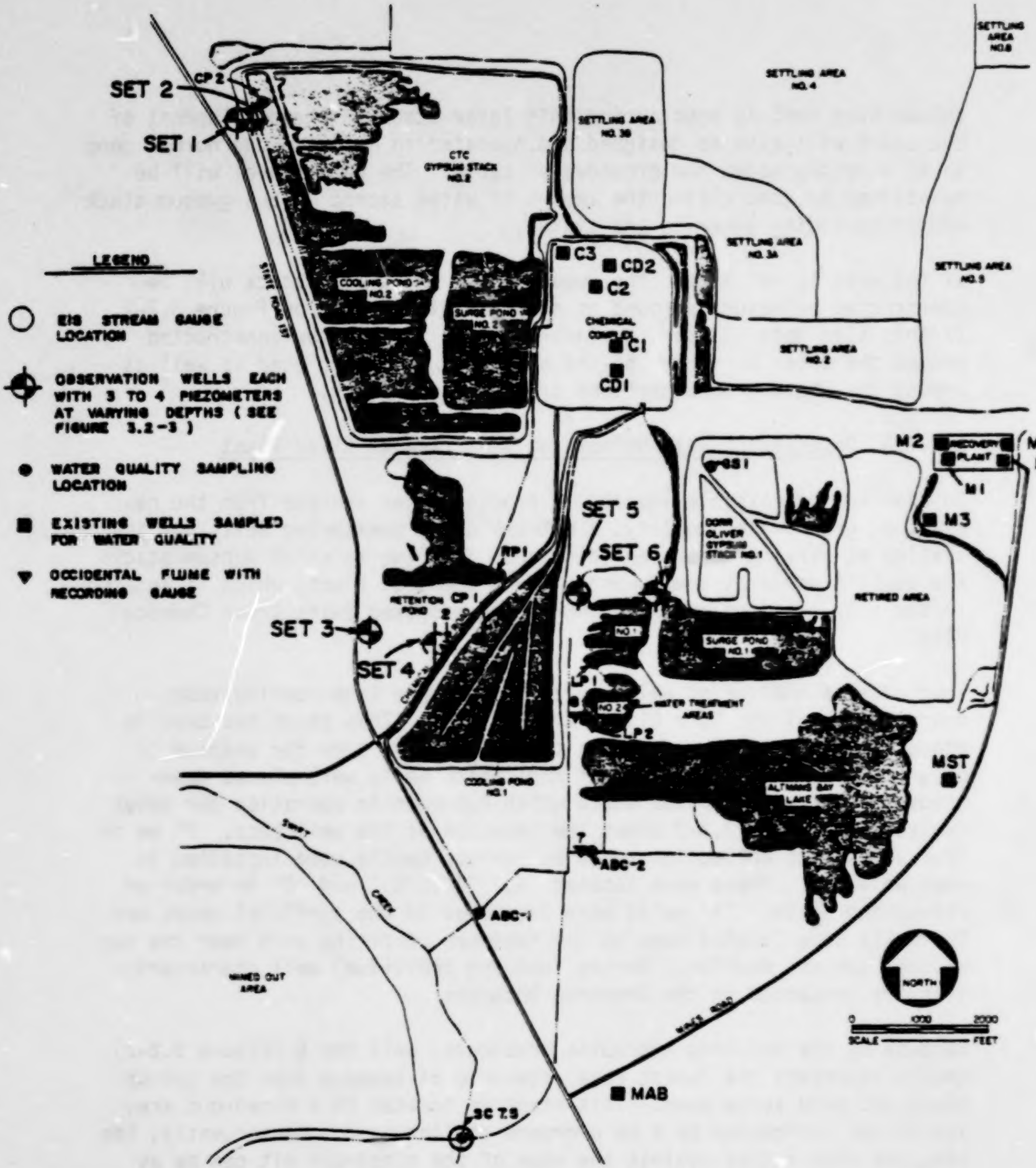
If the area is not mined, the remainder of the gypsum stack will be constructed on natural ground as shown in Alternate 2 on Figure 3.2-1. If this alternate is used, an interceptor ditch will be constructed around the outer periphery of the aboveground cooling pond as well as around the above ground portions of the gypsum stack.

3.2.7.3 Observation Well Network at the Suwannee River Plant

To examine the possible impacts of process water seepage from the new plant on groundwater quality, a network of 22 monitoring wells was installed at varying depths and distances from two existing gypsum stacks and cooling ponds at the Suwannee River Chemical Plant, which is located in the same hydrogeologic setting as the proposed Swift Creek Chemical Plant.

Four sets of monitoring wells were located on a line running west, downgradient of the Dorr Oliver Gypsum Stack. This stack has been in operation for over 10 years thus providing ample time for seepage to occur. In addition, two sets of monitoring wells were placed downgradient of the CTC gypsum stack which has been in operation for about two years. Figure 3.2-2 shows the location of the well sets. Three to four wells with collection zones at various depths were installed in each well set. These were labeled "A," "B," "C," and "D" in order of increasing depth. "A" wells were installed in the surficial sands and "D" wells were located deep in the Hawthorn confining unit near the top of the Floridan Aquifer. Boring logs and individual well characteristics are presented in the Resource Document.

Because of the existing hydraulic gradients, Well Set 6 (Figure 3.2-2) should represent the "worst case" scenario of seepage from the gypsum stack and acid surge pond. This stack is located in a mined-out area and is not surrounded by a belowground cooling pond. Consequently, the pressure head acting against the edge of the mined-out pit can be as high as the elevation of the gypsum stack at that location. With a belowground cooling pond, the corresponding pressure head cannot be higher than the pond elevation. Hence, the quantity of seepage and the potential for contamination of the surficial aquifer at the Dorr Oliver Stack would be greater than for the proposed stack.


SET 2
CP 2
SET 1
CTC GYPSUM STACK NO.2
COOLING POND NO.2
SURGE POND NO.2
STATE ROAD 137
SETTLING AREA NO.3B
SETTLING AREA NO.4
SETTLING AREA NO.6
SETTLING AREA NO.3A
SETTLING AREA NO.5
SETTLING AREA NO.2
C3
CD2
C2
CHEMICAL COMPLEX
C1
CD1
LEGEND
EIS STREAM GAUGE LOCATION
OBSERVATION WELLS EACH WITH 3 TO 4 PIEZOMETERS AT VARYING DEPTHS (SEE FIGURE 3.2-3)
WATER QUALITY SAMPLING LOCATION
EXISTING WELLS SAMPLED FOR WATER QUALITY
OCCIDENTAL FLUME WITH RECORDING GAUGE
M2
RECOVERY PLANT
MD1
MD2
M1
M3
GS1
DORR OLIVER GYPSUM STACK NO.1
RETIRED AREA
SET 5
SET 6
RP1
RETENTION POND
CP 1
2
SET 3
SET 4
NO.1
SURGE POND NO.1
LP 1
NO.2
WATER TREATMENT AREAS
LP2
COOLING POND NO.1
ALTMANS BAY LAKE
MST
ABC-2
ABC-1
SWIFT CREEK
MINED OUT AREA
NORTH
0 1000 2000
SCALE FEET
MAB
SC 7.5

LAYOUT OF MONITORING AND SAMPLING STATIONS (SRCC)
OCCIDENTAL CHEMICAL COMPANY
SUWANNEE RIVER CHEMICAL COMPLEX
HAMILTON COUNTY, FLORIDA

FIGURE 3.2-

3.2.7.4 Impacts of Swift Creek Chemical Plant on Groundwater in the Surficial Aquifer and Hawthorn Formation

Results obtained from the observation wells at the existing plant indicate that contamination of groundwater during the 10-year operating period is limited in depth to the upper 50 feet of the soil profile; i.e., to the surficial aquifer, and horizontally to a distance of less than 1,000 feet from the gypsum stack for most parameters. Figures 3.2-3 to 3.2-9 show concentration profiles in the various collection zones as a function of horizontal distance from the gypsum stacks at the Suwannee River Plant. Profiles are presented for the following important indicators of water quality:* fluoride, sulfate, pH, orthophosphate, specific conductivity, gross alpha radiation and radium-226.

These results represent an upper bound for the impacts from the proposed facility because the existing facilities were not designed to minimize seepage; i.e., the outer periphery of the Dorr Oliver Gypsum Stack (see cross section in Figure 3.2-3) was constructed above the edge of a mined-out pit with no design provisions to minimize the pressure head acting against the surficial aquifer. Consequently, the quantity of groundwater seepage and, hence, the potential contamination leaving the Dorr Oliver Gypsum Stack would be significantly higher than that leaving the belowground pond surrounding the proposed stack.

There is no evidence in the concentration profiles or in any of the other data collected (see Resource Document) which indicate long-range transport of contaminants from the gypsum stacks and cooling ponds within the surficial sands and the upper members of the Hawthorn Formation; i.e., the phosphate matrix and the underlying weathered limestone. Furthermore, there is no evidence that the lower water producing zones of the Hawthorn Formation are contaminated anywhere as a result of seepage of process water from the existing plant.

Based on the above measurements at the existing site and the fact that the geology at the Swift Creek Plant site is essentially the same as that at the Suwannee River Chemical Plant, the impact of the proposed gypsum stack and cooling ponds on the upper groundwater aquifers is predicted to be essentially negligible except in very localized areas surrounding the pond. Contamination will be limited to a relatively small area and depth immediately around the proposed gypsum stack and cooling ponds. Within the zone of contamination, elevated levels of

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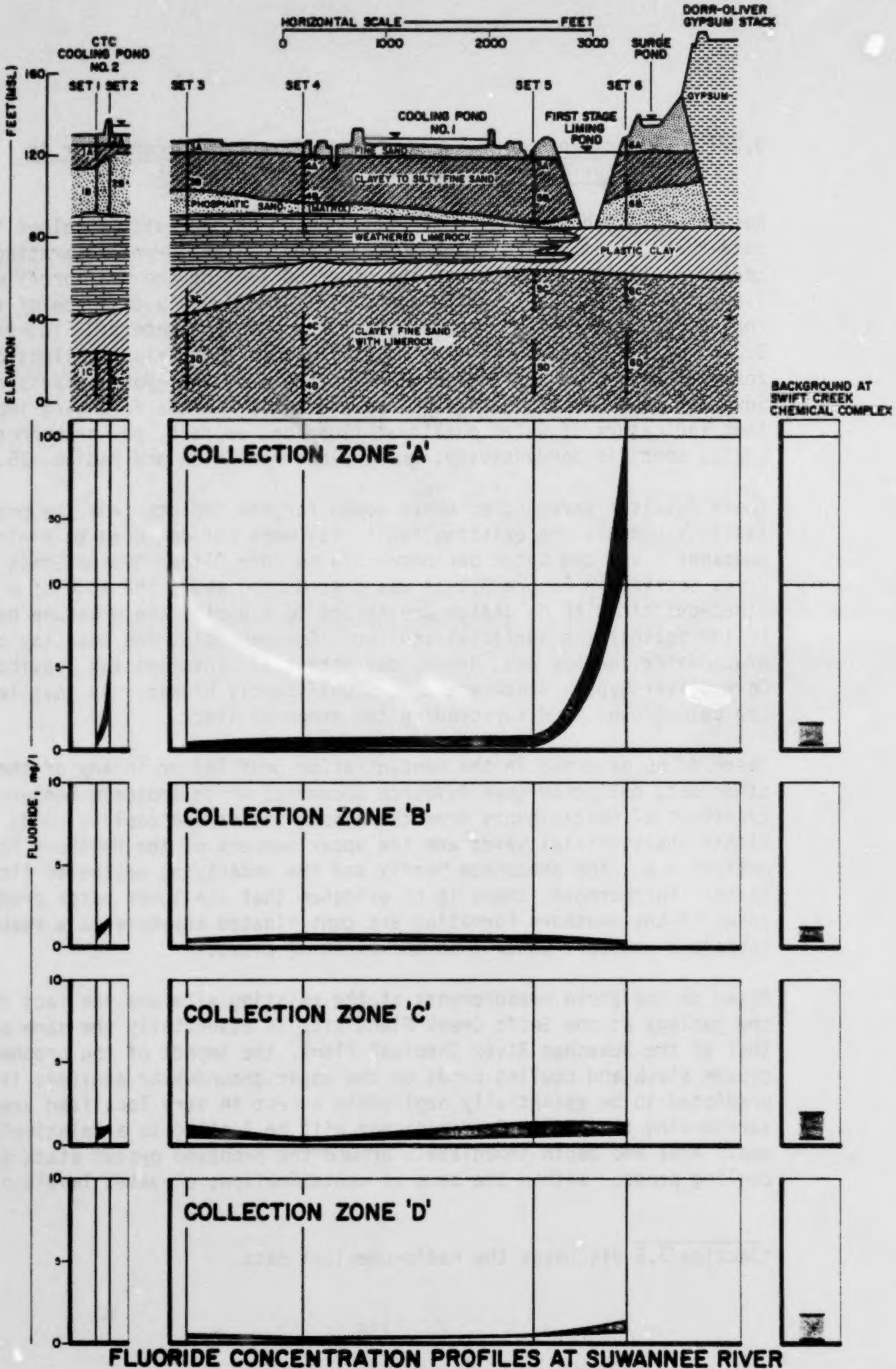
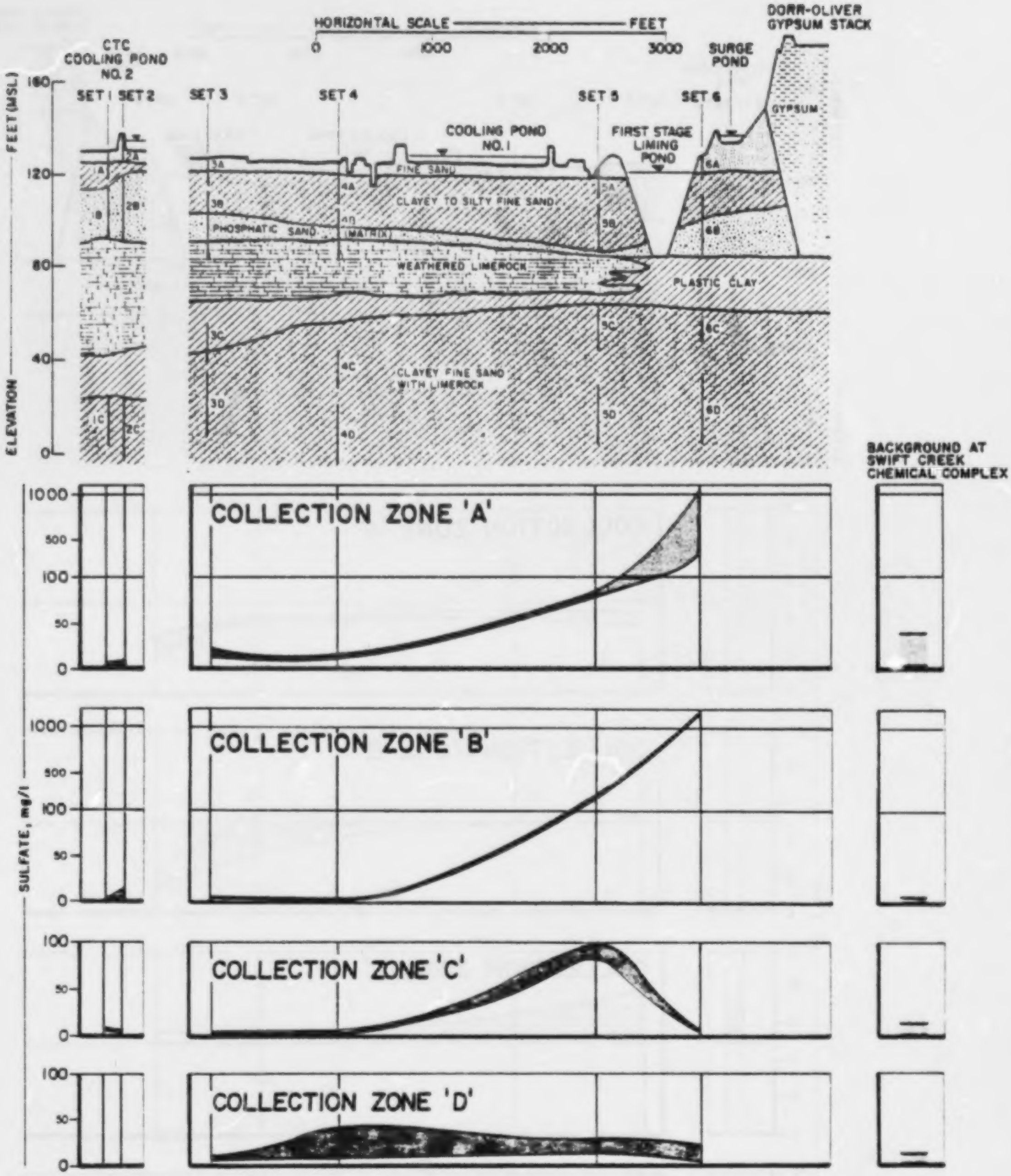
*Section 3.5 discusses the radio-chemical data.



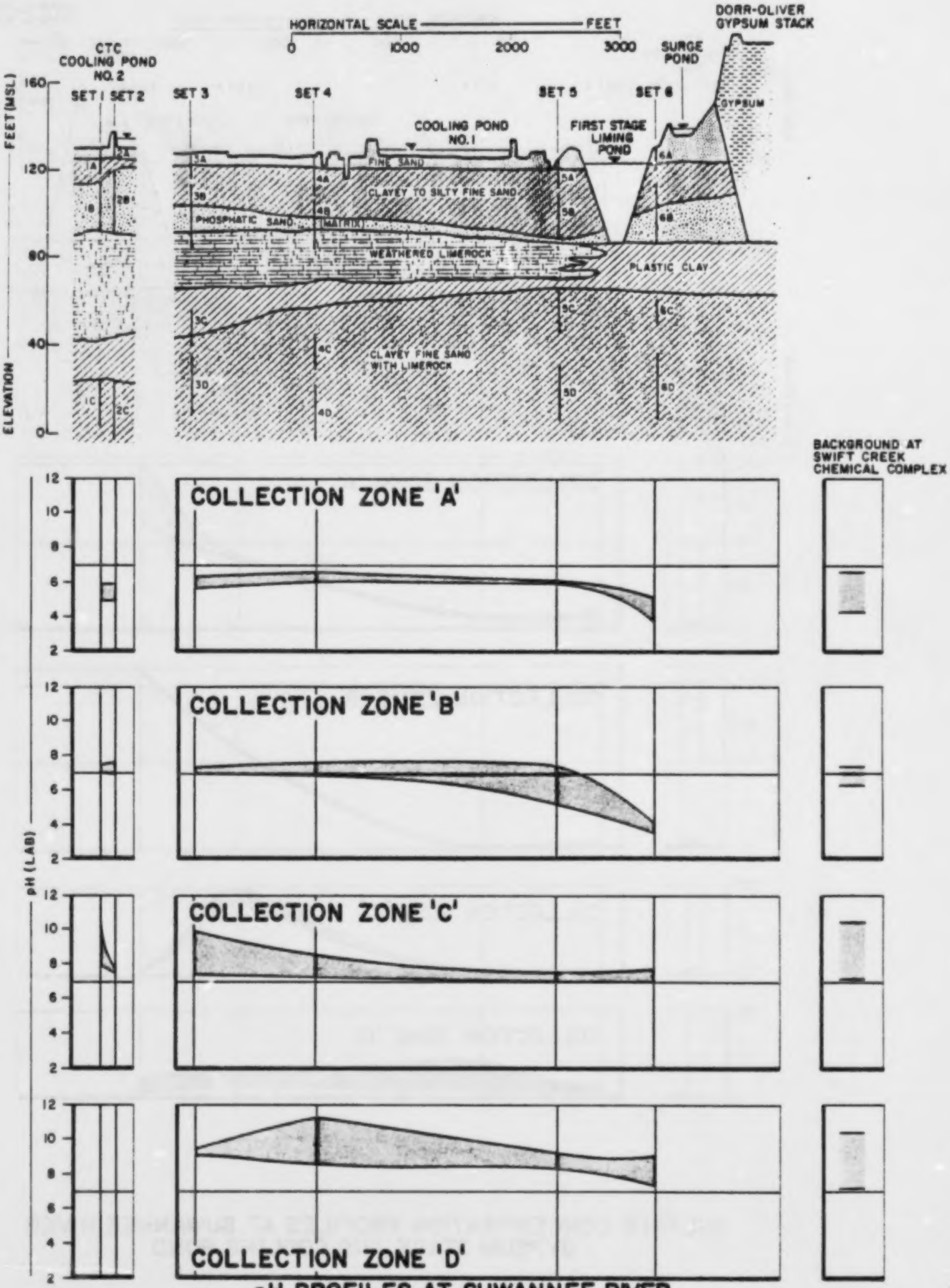
FLUORIDE CONCENTRATION PROFILES AT SUWANNEE RIVER GYPSUM STACK AND COOLING POND

FIGURE 3.2



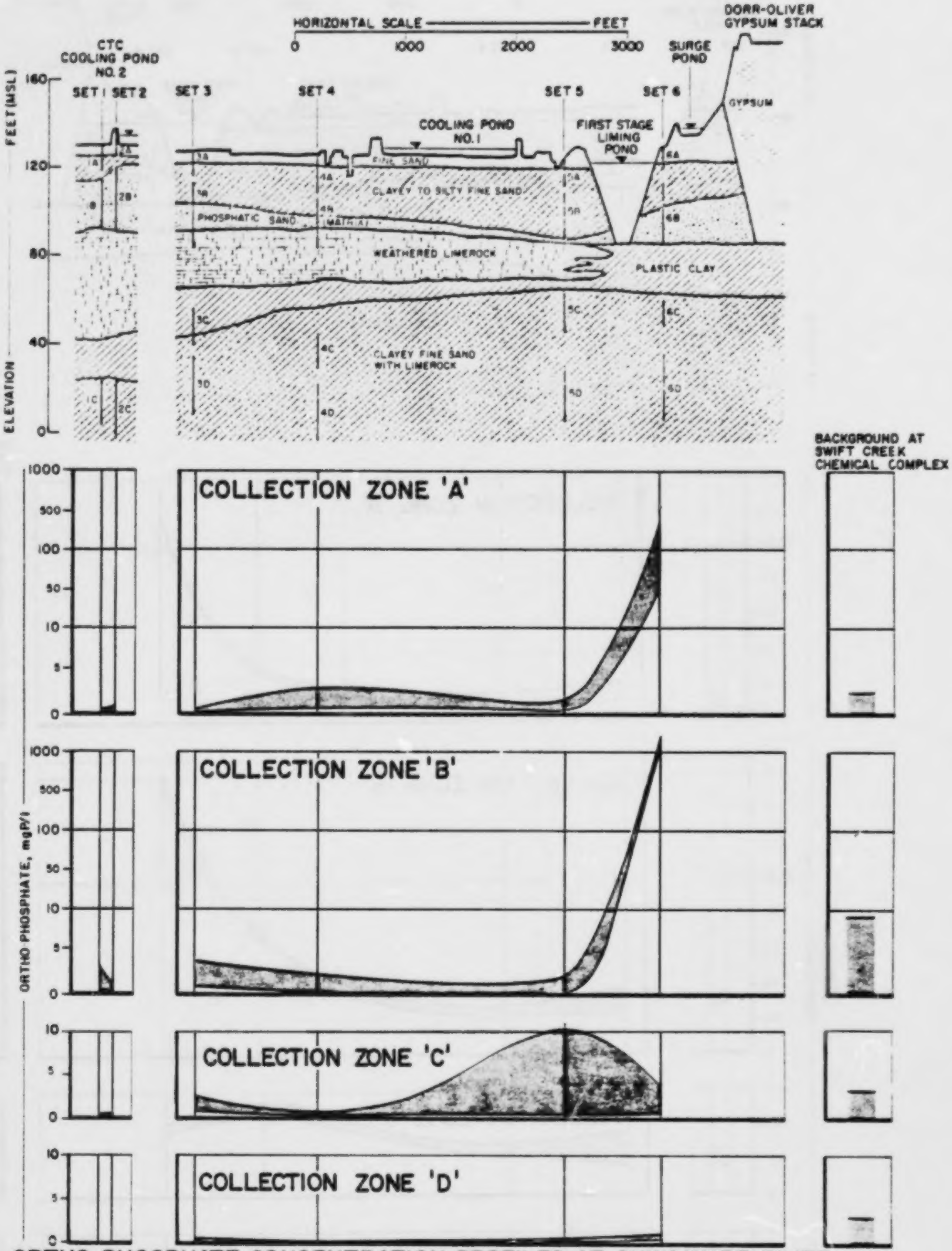
SULFATE CONCENTRATION PROFILES AT SUWANNEE RIVER GYPSUM STACK AND COOLING POND

FIGURE 3.2-4



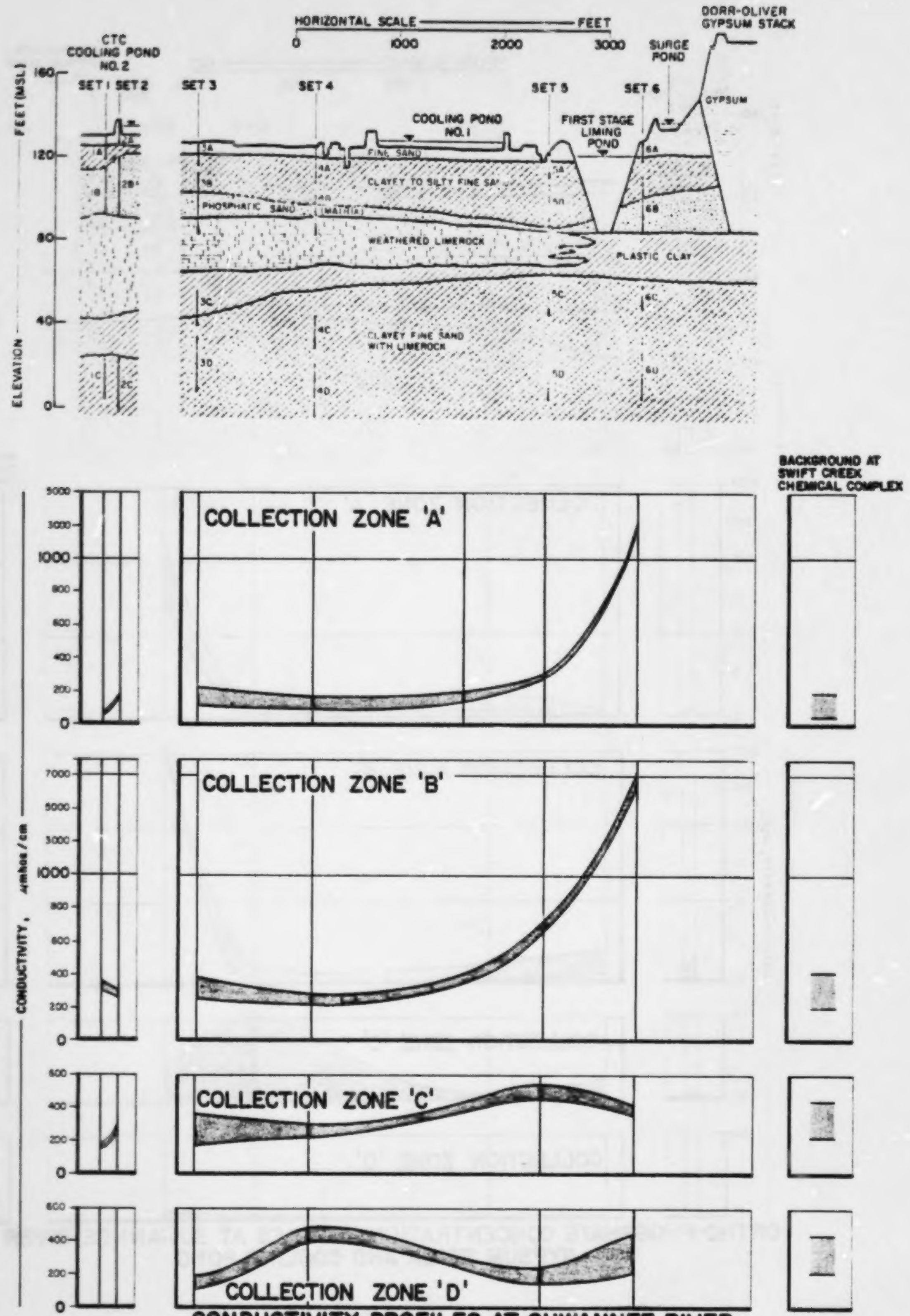
pH PROFILES AT SUWANNEE RIVER GYPSUM STACK AND COOLING POND

FIGURE



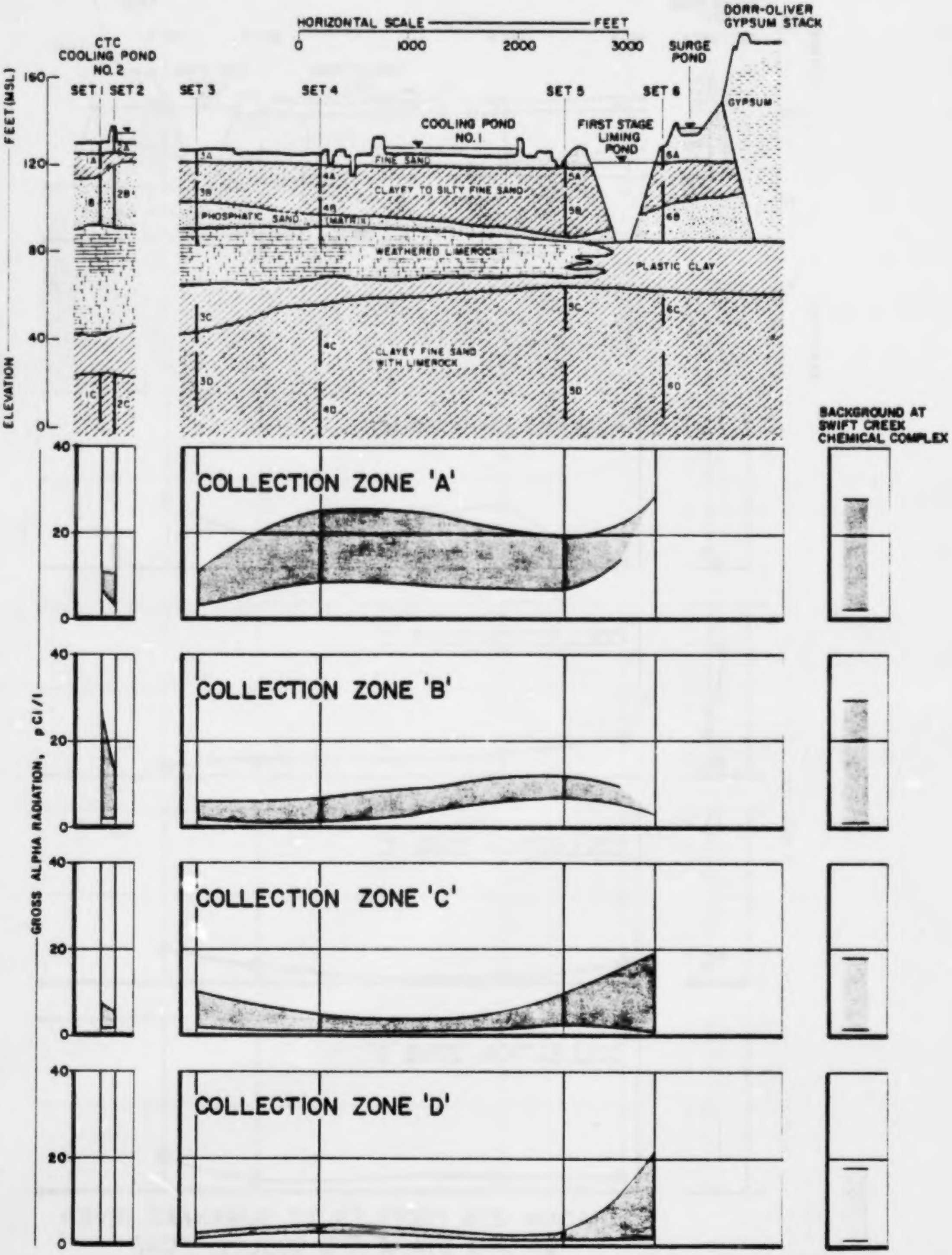
ORTHO-PHOSPHATE CONCENTRATION PROFILES AT SUWANNEE RIVER GYPSUM STACK AND COOLING POND

FIGURE 3.2-6



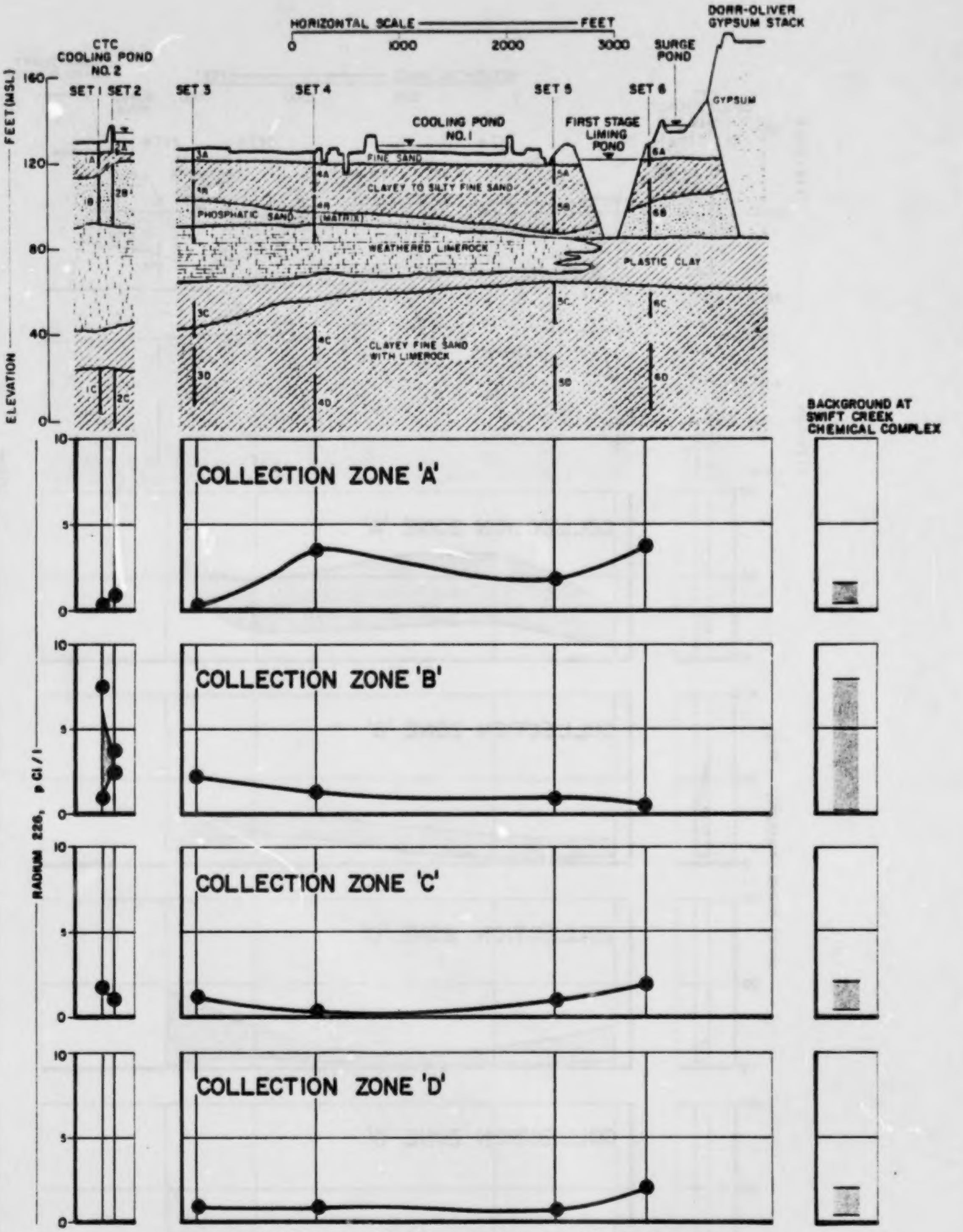
CONDUCTIVITY PROFILES AT SUWANNEE RIVER GYPSUM STACK AND COOLING POND

FIGURE 3.2



GROSS ALPHA RADIATION PROFILES AT SUWANNEE RIVER
GYPSUM STACK AND COOLING POND

FIGURE 3.2-8



RADIUM 226 PROFILES AT SUWANNEE RIVER GYPSUM STACK AND COOLING POND

FIGURE 3.2-9

fluoride, phosphate, sulfate, calcium, and sodium, and lower levels of pH will occur; but, except at very short distances from the stack, all ions will have concentrations within the range found in the Floridan Aquifer.

3.2.7.5 Impacts of the Proposed Facility on Water Quality in the Floridan Aquifer

Because of the head difference between the surficial aquifer and the Floridan Aquifer, some contaminated water from the cooling pond-gypsum stack complex will migrate downward at a very slow rate. During this very slow migration, some of the contaminants, such as phosphate, will be precipitated and/or adsorbed by the clay minerals comprising the confining units. Others, such as fluoride, will be attenuated to a large degree through adsorption by clay minerals and chemical reactions with calcareous formations. Still other contaminants, such as sulfate, will be more or less unaffected during the downward migration of the contaminated water. Any process water which may reach the Floridan Aquifer would further be greatly dispersed by the lateral movement of the water in the aquifer, thus further decreasing the potential for a change in the aquifer's water quality.

The semi-confining bed within the surficial aquifer is too pervious (Section 2.6.3.2) compared to the Hawthorn confining unit to significantly reduce the amount of downward seepage. However, this layer, because of its clay content, will provide attenuation of some contaminants seeping out of the gypsum stack and aboveground cooling ponds.

The proposed plant is not expected to have any effects on groundwater quality in the Floridan Aquifer. This conclusion is based on a comparison of water quality in deep production wells and potable water supply wells at the existing plant with data from similar wells located at the site of the proposed plant, as well as comparison of these data to regional data. Examination of 10 years of chemical data on two deep production wells (collections zones of 180 to 1,265 feet) at the existing plant indicate no monotonic trends in concentrations of major ions over the period of record (see Resource Document).

In summary, numerous analyses indicate that the quality of water in wells at the Suwannee River Plant, at the Swift Creek Plant site, and within the region is similar and within drinking water standards (except in some cases for iron). There is no evidence of any contamination of the Floridan Aquifer at the existing plant site, and, therefore, it is expected that the proposed plant will result in no contamination and no impact on the Floridan Aquifer.

3.2.8 IMPACTS FROM ACCIDENTS AND SPILLS

The probability of having a spill of the ponded water on top of the stack (as a result of an unlikely high magnitude earthquake, for instance) is very low. Nevertheless, the cooling pond surrounding the gypsum stack will have enough surge capacity to fully contain any acid water that may be stored on top of the stack. Hence, in the unlikely event of a spill, acid water will be contained within the system.

LIST OF REFERENCES
(Section 3.2)

Division of State Planning (1973), "Hamilton County Soils Association Map", Florida Department of Administration, Tallahassee, Florida.

3.3 ENVIRONMENTAL EFFECTS OF THE PROPOSED CHEMICAL COMPLEX ON BIOLOGY AND ECOLOGY

3.3.1 SITE CONSTRUCTION IMPACTS

3.3.1.1 Vegetation Impacts

The proposed chemical plant site is a highly disturbed pine flatwoods/pine plantation community. Site construction and related activities will remove most of the remaining previously harvested flatwoods and associated cypresshead habitat. The majority of the vegetation lost will be the flatwoods habitat. The impact due to the loss of these vegetative communities is of minor importance when their degraded condition and abundance in the study area is considered. Impacts to Swift Creek Swamp are considered minimal due to drainage controls and the fact that the swamp has already received pit waters which probably have an impact exceeding any anticipated from the plant construction.

There is no prime agricultural land nor development within the area of the proposed plant site. Wildlife habitat will not be substantially affected, since present conditions provide, at best, minimal wildlife habitat.

3.3.2 BIOLOGY AND ECOLOGY

3.3.2.1 Aquatic Communities

Macroinvertebrate, periphyton and fish data from Swift Creek have shown that substrate conditions are apparently more important as stress factors than is water quality. Suwannee River natural system components will not be significantly affected. Only nonprocess water is expected to be regularly discharged from the proposed complex due to an estimated negative water balance and the quality of proposed discharge should be similar to that of the present SRCC. Presumably after 15 years of operations, Swift Creek has fully responded to any impacts associated with the present plant. The aquatic communities will not be adversely impacted by the small increase in flow in the estimated water quality changes.

3.3.2.2 Terrestrial Communities of the Area

Impacts to terrestrial biota can be associated with air pollutant emissions and contaminated water discharges. Air pollutant emissions of significance associated with a phosphate fertilizer complex include fluorides and sulfur dioxide.

Moderate tip necrosis was noted on a few pine trees located on the southern and southwest dikes of an existing cooling water pond at SRCC. No other fluoride effects were noted (also see Section 2.2.2.3.2). Similar very limited fluoride impacts can be reasonably expected at the proposed Swift Creek Chemical Complex.

No sulfur dioxide effects have been noted at SRCC; even with the existence of two old sulfuric acid plants operating with an SO_2 emission rate of 29 pounds SO_2 per ton of acid. The sulfuric acid plants proposed for the SCCC will have an SO_2 emission rate of 4 pounds per ton of acid.

The general impact of the proposed new chemical plant on the faunal components is anticipated to be minimal. Some habitat loss is expected but, due to the present disturbed nature of the site and the type of vegetative communities' abundance within the region, this impact will be minimal. Areas adjacent to the proposed chemical plant may be detrimentally impacted due to an increase in human disturbance in the area. However, this also is considered minimal since there is already a human disturbance factor associated with the existing beneficiation plant and SRCC.

Some loss of terrestrial habitat may occur with the increase in discharge into Swift Creek. This may be particularly detrimental to the already stressed zone of the southern mixed hardwood community on Swift Creek and its associated faunal components.

3.3.2.3 Environmentally Sensitive Areas

No recognized environmentally sensitive areas are located within the study area. Beehaven Bay, located north of the proposed plant site is isolated from the Swift Creek Basin and air emissions from cooling ponds and sulfuric acid plants.

3.3.2.4 Endangered, Threatened and Rare Plants and Animals

The proposed chemical plant will have little impact on listed species of the area. Of concern may be species associated with cypress domes on the area; however, the presence of these species is highly speculative and habitat is severely disturbed.

3.3.2.5 Migratory Wildlife and Habitat

Similarly, a limited amount of habitat for migratory wildlife is available. Plant construction is anticipated to have minimal effect on migrant populations.

3.3.2.6 Wildlife Benefits of the Area to Man

The acreage to be committed to the proposed site facilities is not a significant source of wildlife related recreation. Even if the facility were not constructed, the recreational value would still be negligible due to intensive timber management and expansion of ongoing mining.

3.3.3 LONG-TERM VS. SHORT-TERM IMPACTS

3.3.3.1 Aquatic Impacts

Process water discharge from the proposed chemical plant will occur at very infrequent intervals during periods of high run-off with ample opportunity for dilution. Nonprocess discharge will result in a small increase in the Swift Creek discharge and no additional impacts are anticipated to aquatic organisms. Therefore, comparisons of long-term and short-term impacts will be similar to existing conditions.

3.3.3.2 Terrestrial Impacts

Construction of the proposed facility and associated cooling ponds and storage areas will permanently impact approximately 650 acres of the modified/disturbed pineland/cypress system. The existing but low quality wildlife habitat will be permanently lost. Short-term impacts will occur from air emissions during the life of operation of the proposed chemical facilities. However, based on air impact studies and examination of the area around the existing plant, impacts are considered to be of minor significance and limited areal extent.

3.3.4 REVERSIBILITY

3.3.4.1 Aquatic Impacts

Since there are no anticipated impacts to the aquatic biota, a discussion of reversibility is unwarranted.

3.3.4.2 Terrestrial Impacts

Short-term impacts of air emissions are reversible at the end of the life of the project when air emissions cease. Long-term impacts of the plant facilities construction and associated cooling pond and gypsum storage are to a large extent irreversible. This is due to deposition of various chemicals into cooling ponds and gypsum storage areas which are detrimental to the establishment of a plant community.

3.4 SOCIOECONOMIC IMPACT

3.4.1 INTRODUCTION

There are three geographic areas of impact: (1) local, primarily Hamilton, Columbia and Suwannee Counties in North Florida; (2) regional, the state of Florida and, to some degree, South Georgia; and (3) national and international.

The effects at the state and local levels are felt mainly through increases in employment and incomes, though there will be other effects as well. Increases in local and state incomes will be $15.3 million and $25.3 million, respectively, while $2.0 million will be added in local and state tax revenues annually. The national and international effects will be felt primarily through changes in the national import-export balance, international payments, national resource balance, and the national energy situation.

These various forms and levels of impact will be discussed looking at the local impacts of the project in terms of incomes, employment, population, households, school enrollment, demands for public services and local government revenues.

Next, the impacts on a statewide, national and international basis will be evaluated.

The impacts and methodology are discussed in detail in Section 3.4 of the Resource Document.

3.4.2 LOCAL IMPACTS

Occidental's employment and payroll at their existing Hamilton County facilities over the past several years have been:

Year	Employees	Payroll
1974	1,032	$ 9,972,485
1975	1,363	18,303,495
1976	1,246	17,822,593
1977	1,031	17,747,966

Employment and payrolls for 1978, 1979 and 1980 are projected as follows:

Year	Employees	Payroll
1978	1,200	$19,099,142
1979	1,350	23,186,544
1980	1,700	31,508,000

The projection for 1978 is based on Occidental's current budget. The projection for 1979 includes payroll for Phase I of Occidental's expansion and for 1980, employment and payroll for the Phase II expansion (the new plant at the Swift Creek site.

As of September 1977, 95 percent of Occidental's employees lived within the three-county area of immediate impact. Thirty-one percent lived in Columbia County, 37 percent in Hamilton County, and 19 percent in Suwannee County. It is assumed that after the planned plant expansions approximately 90 percent of all employees will live in these three counties.

While the income and employment impacts of Occidental and the new expansions are significant in terms of Occidental's own employment and payrolls, this represents less than 2/3 of the total impact on the three-county local area. The rest is from indirect, and induced impacts as shown in Table 3.4-1. The induced impact results from increased consumer expenditures resulting from the direct and indirect impacts.

Thus, Occidental's Phase I expansion will generate $5.0 million direct and $7.9 million total in annual earnings for residents of Columbia, Hamilton and Suwannee counties. Phase II will generate $10.0 million direct and an additional $15.3 million total earnings.

Table 3.4-2 contains a summary of the effects of Occidental on employment within the three counties. The 624 increase in permanent employment in the three counties from 1979 to 1980 is a result of the Phase II expansion. In addition, it is estimated that there will be a short-term employment impact during Phase I of 2,185 people and during Phase II of 4,560 people. Of course many, but not all, of these will be temporary construction workers. Some will be local residents whose jobs will continue after the plant goes into operation.

Table 3.4-3 summarizes Occidental's impacts on several important socioeconomic variables. In Table 3.4-3 the impacts for 1980 are cumulative and include both first and second stages of the expansion. The impact of the second stage only is shown in the last column.

The relative importance of Occidental to the economy of north Florida as well as the effect of expansion can be seen in Figure 3.4-1. For example, in 1980 the income impacts of the overall facility will represent $53.0 million out of $349.0 million total earnings for the three-county area. The totals include $15.0 million for the Phase II expansion.

Added education costs in 1980 in the three counties as a result of both stages of the expansion will be about $1,741,000 in 1980 dollars. The total local government costs of both phases of the planned expansion will be $2,130,000. These costs will more than offset by taxes paid Occidental and by individuals and businesses as direct and indirect results of the expansion.

In 1976, Occidental paid about $600,000 in property taxes. It is estimated at $960,000 for 1979 and possibly $2 million in 1980. Thus, local property taxes will increase by some $1.4 million as a result of both phases of their expansion. Most of this will be paid in Hamilton County.

It has been estimated that the land use effects of Phase I could result in some 35 acres of land in the three counties being converted to residential uses--about 300 more could be converted as a result of Phase II. In total, some 350 acres within the three-county area might be converted to residential uses--a ratio of only three in every 10,000 acres.

Table 3.4-1. Summary of Occidental's Impacts on Income in the Area of Immediate Impact for 1978, 1979, and 1980

Impact	1978	1979	1980
Direct	$21,209,433	$26,829,045	$37,471,691
Indirect	3,791,101	4,641,962	6,692,666
Induced	5,039,938	6,456,447	9,080,228
Total	$30,040,472	$37,927,454	$53,244,585
Change from Preceding Year	--	7,886,982	15,317,131*

*Second stage expansion impact.

Table 3.4-2. Summary of Occidental's Impacts on Employment in the Area of Immediate Impact for 1978, 1979, 1980.

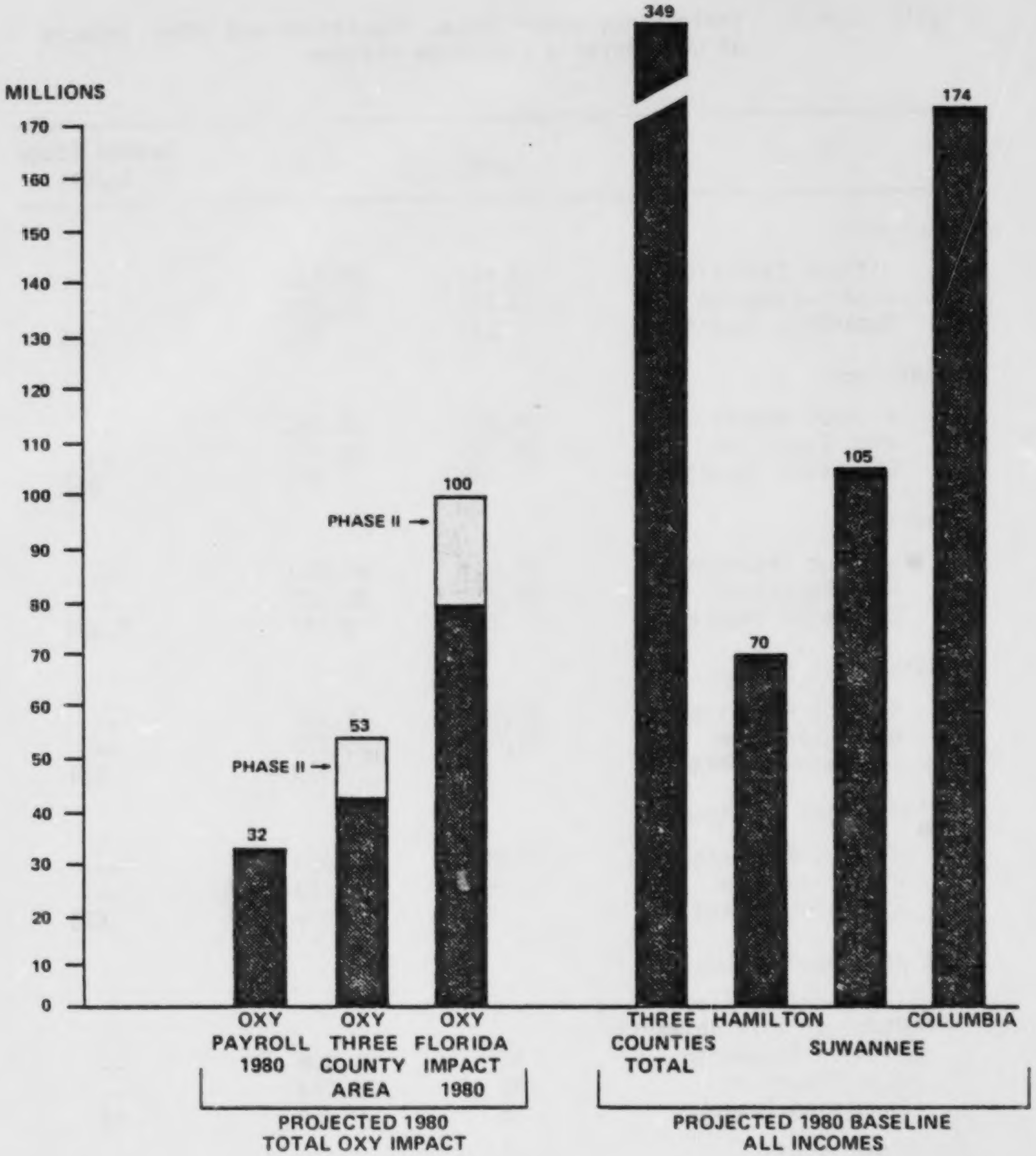
Impact	1978	1979	1980
Direct	1,320	1,527	1,950
Indirect	268	330	408
Induced	310	372	495
Total	1,898	2,229	2,853
Change from Preceding Year	--	331	624*

*Second stage expansion impact.

Table 3.4-3. Employment, Labor Force, Population and Other Impacts of Occidental's Expansion Program

	1979	1980	Second Stage Impact
Employment			
Without Expansion	23,443	24,186	--
With Expansions	23,774	25,455	--
Expansion Impact	331	955	624
Labor Force			
Without Expansion	24,677	25,459	--
With Expansion	24,765	26,378	--
Expansion Impact	88	919	831
Population			
Without Expansion	61,964	63,500	--
With Expansion	62,228	66,257	--
Expansion Impact	264	2,757	2,493
Housing Unit Needs			
Without Expansion	23,564	24,351	--
With Expansion	23,652	25,270	--
Expansion Impact	88	919	831
Public School Enrollment			
Without Expansion	13,626	13,953	--
With Expansion	13,692	14,542	--
Expansion Impact	66	689	623
Cost of Nonschool Local Public Services (In Thousand of 1974 dollars)			
Without Expansion	NE	$8,805	--
With Expansion	NE	9,063	--
Expansion Impact	NE	258	NE

Note: NE = not estimated.



OCCIDENTAL'S TOTAL INCOME IMPACT AS COMPARED TO ESTIMATED LABOR AND PROPRIETORS INCOME IN THE IMMEDIATE IMPACT AREA, 1980

FIGURE 3.4-1

It is likely that most of this land will be near the existing urban centers. Since there are large areas of undeveloped land within each of the existing cities within the three counties, projected growth will not cause any significant reduction in the amount of land available for other purposes.

3.4.3 STATEWIDE IMPACT--EMPLOYMENT, INCOME, TAX RECEIPTS

The direct, indirect and induced impacts of Occidental's expansions on income earned by residents of the state of Florida will be $15 million per year for Phase I starting in 1979 and $25 million per year for Phase II starting in 1980 (Table 3.4-4).

About 60 percent of the income generated by Phase II of the project will be concentrated within the three-county area. The remainder will be distributed in the State, although the major part of it will probably remain in North Florida.

In addition, Phase I construction will result in about $74.0 million in state income ($20.0 million in local area) from 1977-1979. Phase II construction will generate some $144.0 million in state income ($46.0 million in local area) from late 1978-1980.

The impact of Occidental's expansions on direct, indirect and induced permanent employment is shown in Table 3.4-5. The effect of both phases of expansion will be to increase total employment in Florida by 1637 permanent jobs, 1148 of which will result from Phase II. As has already been shown, 624 of these 1148 jobs will be held by residents of the three-county impact area.

In addition, Phase I construction is expected to generate 4657 temporary jobs statewide--Phase II, 8396. Based on unemployment statistics, it is likely that most of the new jobs can be filled from within Florida. Therefore, it is likely that while the project will have little or no effect on statewide total population, housing needs, school enrollments, or governmental expenditures, it will contribute to income, employment, and the tax base.

Annual state sales tax receipts are expected to increase over 1976 by $1.6 million direct from Occidental and $1.4 million indirectly as a result of spent income generated by both Phase I and II. The $3 million total includes $1.3 million resulting from the Phase II expansion. In addition to this will be increased corporate profit taxes, and motor vehicle taxes. While it may be necessary for the state to reallocate some of its transfer payments to local governments within the three counties to compensate for some increased costs, there is unlikely to be any increased state government costs as a result of the expansions. More likely there will be a reduction in unemployment compensation and other forms of public assistance.

Table 3.4-4. Summary of Occidental's Impacts on Income in the State of Florida, 1978, 1979, 1980

Impact	1978	1979	1980
Direct	$34,232,141	42,479,463	56,458,428
Indirect	9,118,597	11,427,945	15,193,021
Induced	16,140,595	20,857,126	28,413,381
Total	$59,491,333	74,764,534	100,064,830
Change from Preceding Year	--	15,273,201	25,300,296*

*Second Stage Expansion Impact.

Table 3.4-5. Summary of Occidental's Impacts on Employment in the State of Florida, 1978, 1979, and 1980

Impact	1978	1979	1980
Direct	2,033	2,264	2,946
Indirect	610	703	862
Induced	1,044	1,209	1,516
Total	3,687	4,176	5,324
Change from Preceding Year	--	489	1,148*

*The impact of the Phase II expansion.

3.4.4 NATIONAL AND INTERNATIONAL IMPACTS--OCCIDENTAL-U.S.S.R. TRADE AGREEMENT

These impacts will result from the shipment of SPA produced in the new plant to the Soviet Union in return for anhydrous ammonia, urea and potash. There are a number of effects:

- short and long run balance of trade;
- energy trade;
- balance of payments;
- national resource depletion; and
- foreign exchange value of the U.S. dollar.

The agreement calls for Occidental to sell 1.0 million metric tons per year of SPA to the U.S.S.R. for 20 years beginning in 1980 and for Occidental to puchase from the U.S.S.R. 1.5 million metric tons per year of anhydrous ammonia, 1.0 million metric tons per year of urea, and 1.0 million metric tons per year of potash for the same 20-year period. The quantities shipped could vary somewhat depending upon each commodities' relative value in the world market. The value on the world market of the SPA shipped to Russia is to be equal in value to the ammonia, urea and potash purchased from the Soviet Union. That is, the whole agreement is to result in an equal value in terms of world prices.

Occidental is also to purchase 0.6 million metric tons per year of anhydrous ammonia from the U.S.S.R. at world market prices. This will provide the foreign exchange with which the U.S.S.R. can pay the United States companies involved for construction of the SPA terminals, pipelines, ammonia plants, and railcars which are required for them to produce, ship and receive the commodities involved.

3.4.4.1 Effects on U.S. Balance of Payments and Balance of Trade

Several indirect effects on the U.S. trade and payments balance are expected. First, to the extent that the U.S. requirements of potash can be supplied through the Occidental-U.S.S.R. trade agreements, it will not be necessary to import potash from Canada. In 1976, the U.S. imported 3.7 million tons of potash. Second, to the extent that Occidental brings in ammonia and urea it will not be necessary to import ammonia and urea. In 1976, the U.S. imported some 1.2 million tons of nitrogen fertilizer materials. Third, is assurance of a long-term supply of nitrogen fertilizer materials to American farmers for the production of grain crops. These have been one of our greatest foreign exchange earners.

Fertilizer for the production of food and fiber is important because the demand in the U.S. is projected to continue its compound annual average growth rate in the period 1962-1976. In this period, consumption of nitrogen products grew by 8.3 percent per year; phosphate 4.6 percent; and potash 6.1 percent.

A predominant source of nitrogen for fertilizer is anhydrous ammonia and urea, both of which use natural gas as a feedstock. Thus, for the foreseeable future the extent of the domestically available supply of ammonia and urea for the fertilizer market will depend heavily upon the availability of natural gas.

There is a sufficient reserve of known and recoverable phosphate rock within the United States to meet U.S. demands for many decades to come. On the other hand, there appears to be a general agreement that the known reserves of natural gas in the United States will be depleted in about 15 years. It is possible that ammonia will be made from coal eventually but for the time being this is not feasible.

The conclusion is, then, that the Occidental-U.S.S.R. trade agreement may assure that American agriculture will have a source of ammonia and urea for fertilizer which might otherwise not be available. This will contribute to agricultural productivity and will perhaps make possible the continued export of grain which has been one of our largest foreign exchange earners.

3.4.4.2. Depletion of a Valuable Natural Resource

The question is raised of whether a trade agreement between a private firm and a foreign government could result in one of our country's valuable natural resources being traded to a foreign nation at the expense of future American generations. Alternatively, the trade could be viewed as an exchange of one valuable natural resource for others which are less abundant within the country.

At current consumption rates (116 million tons per year), the United States could provide phosphate for the entire world for 42 years, that is assuming that no other country produces phosphate and that the subeconomic resources become economic.

The U.S. phosphate industry could also continue the current production rate (49 million tons per year) for domestic consumption and exports for the next 66 years using only known reserves and for the next 100 years using the reserves plus the identified subeconomic resources. This does not include vast quantities which cannot be mined and processed with present technology, but could be with higher prices and new technological developments (Stowasser, 1977; Douglas et al., 1977).

By contrast, the United States has only very limited potash resources and already imports the great bulk of our needs (Wagner, 1977).

Similarly, natural gas, the primary raw material for anhydrous ammonia and urea production is in short and dwindling supply in the United States. The United States now has sufficient natural gas reserves to last perhaps 15 years at the current rate of consumption (Bankston, 1975; Federal Energy Administration, 1976).

* For more complete references, see Section 3.4.3.2 of Resource Document.

Shortages of natural gas have and will continue to affect ammonia production. The agreement will help to alleviate shortages which are likely to result in the future.

3.4.4.3 Energy Implications of the Occidental-Soviet Union Trade

Given the current national concern with dependence on imported oil and future energy sources the effects of this trade on domestic energy supply, balance of payments and, in turn, on rate of inflation could be important.

There is a signficant energy advantage to the United States involved in the trade agreement due to the nature of the products involved. Estimates in Table 3.4-6 (based on modern new large ammonia and urea plants in the U.S. and modern potash mines and plants in Canada) show that the annual energy used to produce ammonia, urea, and potash to be imported from Russia is equal to 97.5 trillion BTUs. In comparison, Superphosphoric Acid requires 11.29 trillion BTUs--an energy advantage to the United States of 8.64 to 1.0.

The estimated energy advantage of 86.21 trillion BTUs per year over the 20 years of the trade agreement is comparable to 1.72 trillion SCF of natural gas (1,000 BTU/SCF basis) or equivalent to the discovery of several large natural gas fields. It would also be enough to serve for all uses in the state of Florida for about six years.

Another estimate (based on average energy usage in existing U.S. plants) predicts a larger energy advantage of 14.8 to 1.0 (White, 1977). The true energy advantage to the U.S. is probably somewhere between the two estimates.

3.4.5 SOCIOECONOMIC PROJECTIONS

Baseline projections of all socioeconomic variables, without the expansion, were presented in Section 2.8 of the Resource Document. This section shows projections for selected variables for 1980, 1985, 1990 and 2000, with the expansion.

Statewide--The value of earnings, employment and taxes are expected to be substantial but will represent small percentages of the state totals. For example, by the year 2000 the State annual earned income will run $73 million more (1974 dollars) with the expansion. But this amounts to 0.1 percent of total earned income in the state that year.

Local--The relative impact within the three-county area will be much larger. Employment, earned income and labor force will increase between 4 and 7 percent (Table 3.4-7).

With the expansion about 6 percent more occupied housing units are expected. However, residential land use in the three counties is not likely to increase more than 3 percent because of an expected increase in density.

Population and labor force are each expected to increase 4 percent; employment 5 percent; and earned income 7 percent.

Table 3.4-6 Energy Requirements of Occidental-Soviet Union Trade

Product	Trade Metric Tons Per Year	Energy to Produce BTU/MT	BTUs/Year In Trillions
IMPORTED			
Anhydrous Ammonia[A]	1,500,000	43.50×10^6	65.25
Urea	1,000,000	30.72×10^6	30.72
Potash	1,000,000	1.53×10^6	1.53
TOTAL IMPORTED:			97.50
EXPORTED			
Superphosphoric Acid[B]	700,000	16.13×10^6	11.29
TOTAL EXPORTED:			11.29
ENERGY ADVANTAGE			
Imported/Exported			8.64
20 Year Trade, BTU/s Trillions[C]			1,724.20

[A] Does not include 0.6 million metric tons to be shipped over a 10-year period to provide U.S.S.R. with foreign exchange to pay for Russian port and plant facilities, equivalent to 26.1 trillions BTUs.

[B] 7000,000 MTPY P_2O_5 as 70% SPA shipped. Equivalent to 1,000,000 metric tons of SPA per year.

[C] Natural gas equivalent 1.72 trillion standard cubic feet; Florida usage 0.26 trillion standard cubic feet per year.

Table 3.4-7. Projections of Population, Labor Force, Employment, Earned Income and Other Socioeconomic Variables For the Three-County Area With and Without Occidental's Expansion

	Year			
	1980	1985	1990	2000
Population				
Without Expansion	63,500	69,600	74,200	82,000
With Expansion	66,257	72,513	77,288	85,506
Civilian Labor Force				
Without Expansion	25,459	27,912	29,768	32,912
With Expansion	26,387	28,886	30,800	34,088
Employment				
Without Expansion	24,186	26,517	28,280	31,267
With Expansion	25,455	27,837	29,650	32,714
Percent Unemployed				
Without Expansion	5.0	5.0	5.0	5.0
With Expansion	3.5	3.6	3.7	4.0
Total Earned Income (in millions of 1974 dollars)				
Without Expansion	\$239.0	\$302.0	\$372.8	\$559.2
With Expansion	254.9	322.1	397.6	596.4
Per Capita Earned Income (in 1974 dollars)				
Without Expansion	\$3,764	\$4,339	\$5,024	\$6,820
With Expansion	3,847	4,441	5,144	6,975
Housing Units				
Without Expansion	24,351	25,707	26,431	29,211
With Expansion	25,270	26,637	28,072	31,001

School enrollment (Table 3.4-8) and other local governmental costs in 2000 will probably increase 34 percent although per capita costs are likely to be less.

The expansion will be self contained for the following services normally provided by local government expenditures:

- Sewage Treatment;
- Fire Protection;
- Potable Water;
- Storm Drainage; and
- Garbage Disposal.

3.4.6 SUMMARY

3.4.6.1 State and Local

624 new jobs will be created with Columbia, Hamilton, and Suwannee Counties. 1148 new jobs will be created within the State of Florida. Income earned in the three-county area will be increased by $15.3 million. Income earned by residents of Florida will be increased by $25.3 million.

State sales tax collections will be increased by approximately $1.6 million in payments by Occidental. Additional sales tax revenues will be realized as a result of the statewide earned income mentioned above.

Occidental will pay some $1.4 million in additional local property taxes. The growth in population and business in the three-county area which will be stimulated by the expansion will result in other property improvements and, therefore, additional increases in property tax collections.

Some 2493 additional people will live in the three-county area. This will result in approximately proportional increases in school enrollments in the three counties, as well as similar increases in the demand for other public services.

The expected increase in population will result in a shift of some 333 acres of land in the three-county area from other uses to residential uses.

3.4.6.2 National and International

There will be both long-term and short-term improvements in the U.S. balance of trade and payments. This will contribute to some strengthening of the dollar in international finance.

The national balance of non-renewable resources will be improved. While the nation will give up some of its phosphate (which is in relatively abundant supply in the United States by even the most conservative accounts), it will gain access to Russian potash and natural gas. The

U.S. presently has to import virtually all of the potash it uses and its natural gas reserves are rapidly nearing depletion.

The Occidental-Soviet trade agreement is in keeping with and is a contributing element in the U.S. policy of detente with Russia.

Table 3.4-8 Projected School Enrollments, Public Service Costs, and Revenues, With and Without Occidental's Expansion (Within Local Impact Area)

	Year			
	1980	1985	1990	2000
School Enrollment				
Without Expansion	13,953	15,460	16,913	18,508
With Expansion	14,642	16,199	17,515	19,183
School Expenditures (Thousands of 1974 dollars)				
Without Expansion	$23,416	$24,640	$27,567	$30,167
With Expansion	24,572	26,865	28,548	31,267
Local Government Expenditures (Thousands of 1974 dollars)				
Without Expansion	$ 8,805	$ 9,660	10,284	$11,322
With Expansion	9,063	9,929	10,697	11,909

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(SECTION 3.4)

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3.5 RADIOLOGICAL

The baseline conditions of the radiological environment of the site have been summarized in Section 2.9. The proposed plant and continued mining may alter both of these conditions. The purposes of this section will be: (1) to describe the redistribution of the radioactivity and radiation, (2) to propose potential contamination and exposure pathways, (3) to predict or estimate the effects on man or the environment, (4) to provide comparative measures for proper perspective, and (5) to substantiate the basis for mitigative measures.

3.5.1 RADIOACTIVITY BALANCE

The following discussion will attempt to follow the flow of radioactivity through the mining, beneficiation, and superphosphoric acid production for the proposed plant.

In the mining process, overburden must first be stripped away to gain access to the phosphate matrix. Core analyses have shown the radium-226 profile in north Florida overburden to range from less than 1 pCi/g near the surface to over 10 pCi/g at the matrix interface.

The general end result of mining and reclamation would be to change this radium-226 profile into a more uniform one with depth, and having some average concentration of radioactivity higher than the original topsoil but much lower than the highest fraction in the profile.

In the west central Florida operations, topsoil (≈ 0.2 pCi/g), overburden (≈ 3 pCi/g), leached zone material (≈ 18 pCi/g), and inadvertently discarded matrix (38 pCi/g) become reclaimed overburden with a rather homogenous radium-226 profile having between 4 and 8 pCi/g.

For the north Florida site the resulting mixture in reclaimed overburden should be lower than in west central Florida. Two cores taken on reclaimed land in an earlier study at Occidental (Sholtes & Koogler, 1976) demonstrate this fact. Composite radium-226 concentrations in the first 20 feet are 6.6 and 2.8 pCi/g for the respective cores. The proposed EPA guidelines for reclaimed lands are scheduled to be issued for comment in the latter portion of 1978.

The washer/beneficiation step produces a coarse product known as pebble (approximately 5 percent of product by weight), an intermediate sized product known as flotation feed (approximately 95 percent of product by weight), and a fine clay. The clays are routed to a settling area and the liquid recovered for reuse. The west central Florida clays average about 45 pCi/g for radium-226. By comparison to matrix values, the clays at the proposed plant in north Florida should be near 10 pCi/g.

The regulations to be promulgated under the Resource Conservation and Recovery Act of 1976 have considered a limit at 5 pCi/g radium-226 in "waste" materials. Whether or not the production of such wastes by physical processing will be exempt from consideration as a hazardous waste is currently an open question.

The coarse fraction from the washer plant, pebble, results in less differences between north and west central Florida since the west central Florida pebble averages about 57 pCi/g and the north Florida level is near 26 pCi/g. Thus the 1 to 2 difference in a major product.

The flotation step produces concentrate and a sandy waste fraction usually termed tailings. The west central Florida tailings average about 5 pCi/g. Samples from two tailings piles at the Occidental mine in 1976 both resulted in radium-226 concentrations of 3 pCi/g (Sholtes & Koogler, 1976). Thus, the 1 to 2 factor between regions was repeated for this waste fraction and is duplicated in the concentrate with west central Florida averaging 32 pCi/g, while north Florida concentrate is about 18 pCi/g.

Table 3.5-1 summarizes the input-output balance in radioactivity for the chemical processing phase. The chemical plant fractionates the radioactivity into two major portions. The uranium is primarily extracted into the phosphoric acid and the radium is precipitated with the calcium into the waste gypsum. It is immediately obvious from the table that the north Florida site has the same distribution of activity as west central Florida but that the levels are all less by about a factor of two. Relative to similar operations in west central Florida:

1. Occupational hazards of handling input materials should be less.
2. Uranium recovery from the phosphoric acid is less feasible.
3. Radioactivity shipped in products is less.
4. The chemical processes within the plant should present less occupational hazards.
5. Gypsum represents about one-half the source term for radioactivity than a similar quantity in west central Florida.

Table 3.5-1 Radioactivity Balances for Phosphoric Acid Plants and Fertilizer Production: Occidental Chemical Company Compared to West Central Florida

Sample	226 Ra, pCi/g		238 U, pCi/g	
Type	Occidental	W. Central Fla.	Occidental	W. Central Fla.
Input Materials				
Pebble	26	57	23	46
Concentrate	18	37	13	32
Products				
30% Phosphoric Acid	-	0.4	-	30
40% Phosphoric Acid	0.2	-	21	-
* Ammoniated Phosphates	0.5	4	25	70
* Triple Super Phosphates	12	20	26	56
Inplant Materials				
Acid Reactor Scale	22	-	11	-
Filtrate Tank Scale	-	380	-	28
30% Tank Sediment	-	84	-	<1
Waste Material				
Gypsum	14	32	<0.5	<0.5

Source: After Roessler 1977u

* Not a proposed product for the SCCC.

3.5.2 IMPACT OF RECLAIMED LAND ON GAMMA RADIATION

A radiological survey of Occidental mines and plants in early 1976 included 28 gamma radiation measurements on areas which had been mined and reclaimed. The average gamma level was found to be 8 μR/hr. The screening level suggested by EPA (1975) for return of reclaimed lands to unrestricted use is 10 μR/hr. Updated guidelines to be published in the near future are expected to be more restrictive because of a lower design limit for WL in homes on reclaimed land.

3.5.3 SURFACE WATER SURVEILLANCE

Eighteen surface water and companion sediment stations were sampled in October, 1977. Only half of the surface water samples had levels of radium-226 above detection limits. The mean of the positive stations was only about 0.5 pCi/l and the range was from 1.2 to 0.3. The highest value found was in the Suwannee River. There appears to be no serious impact of present operations on the surface water from a radionuclide point of view. Radium-226 values in sediment are highly variable and range from 0.1 pCi/g to 6.0 pCi/g. The source of radium may be from both the natural stream bed and sedimentation of transported solids. There is little way to discern the source.

The Osceola study (Miller, 1977) also monitored the potential radiological contamination from streams in and adjacent to the Occidental mining areas. The Osceola report concluded that the average radium-226 concentrations in the Occidental effluents would probably not exceed those in natural streamflow.

3.5.4 SOURCE WATERS

Table 3.5-2 summarizes the radioactivity monitored in the various source ponds at the SRCC. The gypsum stack and two cooling ponds have comparable radium-226 levels. Sampling of the cooling ponds in early 1976 also yielded similar levels with an indication that the new pond (No. 2) was still building up to an equilibrium level. The levels seen are not unexpected as they are less than one-half the concentration in similar holding areas in west central Florida.

The radium activity in the two liming ponds was found to be nearly two orders of magnitude lower than the cooling ponds and gypsum stack. The levels were comparable to environmental levels. The concentration in the second liming pond was not found to be different from the Altman's Bay discharge. The Osceola study also took samples from the Altman's Bay discharge in October of 1976 and those results agree with the present study.

The current limitations for effluent from the phosphate industry is 9 pCi/l radium-226. The highest discharge point surveyed was some 15 times less than this limit.

Table 3.5-2 Radioactivity in Selected Source Waters at the Suwannee River Complex

Description	No.	Radioactivity, pCi/l				
		Date Sampled	Gross Alpha	Radium-226	Date Sampled	Gross Alpha
Gypsum Stack, Dorr-Oliver	#1	1/17/78	*	26.2	2/24/78	*
Cooling Pond	#1	1/17/78	*	24.8	2/28/78	*
Cooling Pond	#2	1/16/78	*	23.8	2/24/78	*
Chem. Plant Retn. Pond	-	2/28/78	*	4.9		
Liming Pond	#1	2/28/78	*	0.3		
Liming Pond	#2	2/28/78	*	< 0.2		
Altmans Bay Discharge		2/28/78	1.8	< 0.2		
Return Water Ditch**	RD-1	1/18/78	7.2	0.3	2/23/78	3.8
Previous Data(1):						
Cooling Pond	#1	1/27/76	-	30		
Cooling Pond	#2	1/27/76	-	12		
Previous Data(2):						
Altmans Bay Discharge		10/18/76		<0.1		
Spillway #22		10/18/76		0.6		
Spillway #27		10/18/76		0.5		

* Solid Content too high for accurate measurement ** Swift Creek

(1) Sholtes & Koogler, 1976
(2) Miller, 1977

3.5.5 GROUND WATER SURVEILLANCE

Six well sets at the SRCC were selected for monitoring of potential seepage from several ponds in the area of the complex. In addition to other parameters, such as phosphates and fluorides, the groundwater was analyzed for radium-226 and gross alpha activity. At the Swift Creek Complex two well sets were designed to monitor the proposed gypsum stack and two well sets for the proposed cooling pond. The gross alpha activity in pCi/l is an accepted screening procedure for the more costly radium-226 analysis. The EPA drinking water regulations set a limit for gross alpha activity at 15 pCi/l with the requirement to confirm the concentration of radium-226 at a gross alpha screening level of 5 pCi/l. Gross alpha concentrations of 15 pCi/l are usually indicative of less than 5 pCi/l radium-226.

The gross alpha activity for the first sampling of the six well sets at the SRCC averaged 11 pCi/l with a range from 2.3 to 29 pCi/l. This appears to not be significantly different than the average and range observed in Alachua County (Palmer, 1977).

The weighted average of the five categories of wells in the Osceola study was 10 pCi/l gross alpha activity. One must conclude that the first series of surveillance samples did not indicate a higher than expected gross alpha activity in the monitor wells.

The radium-226 analyses from the first series at SRCC taken near cooling ponds containing 24 pCi/l had an average of 1.7 pCi/l with a range of 0.2 to 7.5 pCi/l. This data is also comparable to that obtained by Palmer for Alachua County where no phosphate mining occurs (Palmer, 1977). The Osceola study yielded a range of radium-226 concentration in various well types from < 0.01 to 5.2 pCi/l for 16 samples.

The second series of sampling at SRCC nominally occurred one month after the first round. The data exhibit an interesting phenomena; in 88 percent of the samples the gross alpha activity was lower in the second series. The average level of activity went down by a factor of slightly greater than two.

The data can neither dramatically support nor emphatically deny this seepage because radium-226 is not a good tracer in this environment. Other water quality parameters, especially those items that do not exist in nature, nor have such an ambiguous source, may be better predictors of water movement. Whether the highly insoluble radium would follow such movements is unknown. Note that the analytical procedure for radium involves a coprecipitation of Ra^{++} and Ba^{++} with H_2SO_4. This could mean that solubilizing radium-226 with acid pond waters is less likely than the commonly accepted preface of acid leaching. The production of extremely find particles containing radium-226 by the dissolution of other elements within the media, however, is a potential. Transport of such materials to any significant distance through the subsurface strata would be limited.

The monitor wells at the undisturbed site of the proposed Swift Creek Chemical Complex actually resulted in higher levels. The average gross alpha level on the initial sampling was approximately 16 pCi/l and the average radium-226 level was 2.2 pCi/l. Also the pattern of the lower gross alpha activity in the second sampling was repeated with a reduction by better than a factor of 2 in the average. The data sets from the two areas may not be statistically different, however, this was not tested. The observations at Swift Creek tend to discount any seepage of radium-226 at either the Suwannee River Complex or the proposed Swift Creek Complex.

3.5.6 OCCUPATIONAL EXPOSURES

The proposed chemical plant will alter the distribution of natural radionuclides present in the wet phosphate concentrate feed. The concern of this section will be the potential for radiation exposure to the phosphate workers in the proposed SCCC.

3.5.6.1 External Gamma

Although it was early realized that gamma radiation exposures would probably not present a hazard problem to the industry, the ease and accuracy of gamma radiation measurements made it a prime candidate for screening many areas for other potential hazards.

Table 3.5-3 summarizes the gamma radiation measurements made in various areas of operation for both the existing Occidental Chemical Company Complex and a data summary for other plants surveyed in Florida (Prince, 1977). The immediate conclusion one can draw from this table is that, in general, the Occidental Chemical Company plant data is in the lower portion of the range of data in the total summary for all Florida plants. In almost all cases the average for the Occidental Complex is lower than the average of all Florida plants.

Occupancy factors applied to the higher gamma level locations reduce the annual increase in exposure over background to a factor of 3 lower than the general public radiation protection standard at 170 mrem/yr. In general, gamma radiation exposures in the proposed chemical plant will be elevated no more than one may find in homes and offices made of brick, concrete block and stone outside of the mining area.

3.5.6.2 Radon Progeny

The usual method for measuring radon progeny is by high volume air samplers and counting the alpha activity under various time and filter placement restrictions. The readings are converted to the unit of Working Levels as explained earlier in the Resource Document.

Table 3.5-4 summarizes the results of Prince (1977) for all Florida mines and plants compared to the data taken at the SRCC. The entire spectrum of measurements for other Florida mines and plants has been

Table 3.5-3 Results of Gamma Radiation Measurements for Potential Occupational Hazards in Florida Phosphate Complexes

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Area or Operation	Summary of Florida Mine or Plant Means (a)			Occidental Chemical Company Chemical Complex (b)		
	NP(c)	Ave(Range), μR/hr		N(d)	Ave(Range), μR/hr	
MINING AND WET ROCK						
Dragline areas	6	5	(4-7)	2	5	(5)
Beneficiation	6	12	(5-39)	20	9	(5-21)
Wet rock storage piles	10	67	(24-87)	5	29	(15-41)
Inside storage tunnels	7	17	(7-30)	6	11	(6-24)
Outside Storage tunnels	7	47	(9-73)	5	12	(8-18)
Wet rock storage bins	4	26	(17-58)	5	14	(11-18)
Office/lab buildings	3	15	(7-31)	14	9	(4-16)
DRY ROCK						
Near dryers	6	23	(10-54)	4	13	(11-15)
Inside dryer control room	4	8	(6-11)	1	6	(-)
Grinding area	7	15	(6-60)	2	8	(6-11)
Dry rock unloading	1	34	(34)	2	14	(14-15)
WET PROCESS PHOSPHORIC ACID						
Inside control room	10	34	(6-232)	3	6	(5-6)
Reactor (inside)	-	-	-	1	125	(-)
Reactor (outside)	-	-	-	3	9	(8-10)
Filter level	10	81	(8-364)	4	7	(6-8)
Around filtrate tanks	5	370	(20-712)	1	12	(-)
Above pan filter	9	240	(49-638)	-	--	-
Other in-plant areas	10	33	(21-80)	-	--	-
Gypsum pile	4	23	(20-27)	1	17	(-)
FERTILIZER PRODUCTION						
Product production	13	10	(6-7)	13	11	(6-21)
Fertilizer storage areas	8	14	(6-28)	5	11	(6-14)
Fertilizer shipping areas	4	13	(6-25)	4	12	(6-21)
Office/lab buildings	7	12	(6-34)	(e)		

(a) Summary data from Prince (1977) may include some data from Occidental Chemical Complex and Mines.

(b) Occidental data from internal report to Occidental Chemical Company from the University of Florida.

(c) Number of plants may include a number of measurements at each plant. Some plants may have more than one facility.

(d) Number of measurements at this facility.

(e) Included in office/lab building data under mining and wet rock category above.

Source: After Prince 1977

Table 3.5-4 Results of Airborne Radon Progeny Measurements for Potential Occupational Hazards

	Summary of Florida Mine[a] or Plant Means			Occidental Chemical Company[b] Chemical Complex		
Area or Operation	NP[c]	Ave(Range), mWL[d]		N[e]	Ave(Range), mWL[d]	
MINING AND WET ROCK						
Dragline areas	7	0.4	(0.1-1.6)	-	-	-
Beneficiation	4	0.7	(0.2-1.3)	-	-	-
Wet rock storage piles	3	1.3	(0.1-2)	-	-	-
Inside storage tunnels	11	96.2	(0.7-960)	13	55	(1.7-200)[f]
Outside Storage tunnels	4	4.9	(0.4-16)	8	2	(0.4-5.3)
Office/lab buildings	4	0.3	(0.1-0.6)	1	0.4	(-)
DRY ROCK						
Near dryers	3	0.6	(0.3-1.0)	-	-	-
Inside dryer control room	2	0.4	(0.3-0.6)	-	-	-
Near Raymond mills	4	0.8	(0.6-1.1)	-	-	-
Inside Raymond control room	4	2.0	(0.6-5.9)	-	-	-
Near Ball bills	1	0.3	(-)	-	-	-
Dry rock loading area	1	0.6	(-)	-	-	-
WET PROCESS PHOSPHORIC ACID						
Inside control room	8	2.4	(0.9-6.0)	1	0.9	(-)
Filter level	7	0.8	(0.4-1.0)	1	0.4	(-)
Around filtrate tanks	2	0.7	(0.5-1.0)	-	-	-
Gypsum pile	4	0.6	(0.2-1.3)	-	-	-
FERTILIZER PRODUCTION						
Product production	1	4.2	(-)	-	-	-
DAP production	3	3.0	(0.8-6.6)	-	-	-
ROP-TSP production	2	1.3	(0.1-2.9)	-	-	-
Fertilizer storage areas	7	4.3	(0.4-13)	-	-	-
Fertilizer shipping areas	3	2.1	(1.1-2.6)	-	-	-
Office/lab buildings	8	0.9	(0.3-2.6)	-	-	-

(a) Summary data from Prince (1977) may include some data from Occidental Chemical Complex and Mines.

(b) Occidental data from internal report to Occidental Chemical Company from the University of Florida.

(c) Number of plants may include a number of measurements at each plant. Some plants may have more than one facility.

(d) For ease of presentation mWL are used, i.e., 0.4 mWL = 0.0004 WL.

(e) Number of measurements at this facility.

(f) **Measurement taken prior to addition of forced ventilation**

Source: After Prince 1977

reported in order to provide some estimation of what the hazard may be at the north Florida site. In general, most measurements in north Florida were in the lower range of the summary of plant measurements.

In order to place these readings into proper perspective one must compare them to generally accepted radiation standards. The standard for uranium is four working level months annual exposure. The value of four working level months per year converts to a 170 hour working environment at 0.33 Working Levels. The highest value in Table 3.5-5 for the Occidental Mine and Chemical Plant is 0.055 WL (55 mWL) inside a storage tunnel. The occupancy factor in storage tunnels would be considerably less than 170 hours per week. All tunnels in the industry have since been equipped with forced ventilation, thus markedly reducing these observed levels.

Radon progeny levels in the proposed chemical complex are within statistical variations of natural background in homes outside of this complex area.

3.5.7 SUMMARY

The radiological impacts of the proposed SCCC are as follows:

Gamma Radiation

Occupational Within Plant - Gamma levels will not require any controls. Normal occupancy times at elevated locations lower accumulated doses to within normal background variations.

Radon Progeny in Plant - The only high Working Levels found were in loading tunnel now lowered to insignificant levels with forced ventilation.

Surface Water - This and previous studies have not observed surface water radium-226 concentrations in excess of natural streams. Current treatment technology has proven to be adequate to limit discharges to less than 5 percent of allowable concentrations of 9 pCi/l radium-226.

Groundwater Radioactivity - This and previous studies have not observed groundwater radium-226 concentrations in excess of background in non-mining areas. Radium-226 in groundwaters appears to be associated with local subsurface environment and other water quality factors.

Product and By-Product Radioactivity	- The chemical processing will factionate the wet phosphate concentrate feed into SPA with expected radium-226 and uranium-238 concentrations at 0.2 and 21 pCi/g, respectively, and gypsum with 14 pCi/g Ra-226 and little uranium (<0.5 pCi/g). The uramium in the acid converts to about 60 ppm and recovery is not economically sound. The gypsum matrix of high sulfates keep radium in an insoluble state. The gypsum stack should be covered with low permeability soil at the time of retirement.

The radiological impacts of the associated mining and beneficiation are as follows:

Subsurface Radioactivity	-	Pre-mining radium-226 profiles (1 pCi/g at surface to 10 pCi/g near matrix) will be altered to a mixed overburden of between 3 and 7 pCi/g.
Matrix Radioactivity	-	Radium-226 (8 pCi/g) in the matrix will be fractionated into clays (10 pCi/g), pebble (26 pCi/g), sand tailings (3 pCi/g), and concentrate (18 pCi/g).
	-	Uranium in the matrix will follow the radium-226 in physical separations.
Gamma Radiation Reclaimed Lands	-	The mean outdoor gamma radiation is expected to be elevated from 5 μR/hr to somewhat less than 8 μR/hr.

LIST OF REFERENCES
(Section 3.5)

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SECTION 4.0

ALTERNATIVES TO THE PROPOSED SOURCE

4.1 SITE LOCATION

Three alternate site locations were considered in addition to the present proposed Swift Creek site. The plant could be located at the existing Suwannee River Chemical Complex, or it could be located at a site on the Mississippi River which is presently unidentified, or it could be located in the central Florida area. Since significant environmental impacts are not anticipated at the proposed SCCC, a detailed study of alternative sites is not discussed at length.

4.1.1 SUWANNEE RIVER SITE

Environmental impacts of locating the proposed plant at the SRCC include increased air emissions in a small area and a small additional amount of fugitive dust. Economic results would be increased electrical energy consumption, increased potentials for occasional pipeline leaks and spills of gypsum slurry and pipeline water, and a substantial capital and operating cost increase. The socioeconomic impacts of expansion of the facilities at the site of the existing plant will be the same as at the Swift Creek site. Consideration of these environmental and economic factors leads to the conclusion that this is not a realistic alternative.

4.1.2 MISSISSIPPI RIVER SITE

This is not a practical plant site for Occidental because of: (1) the environmental effect of continuously discharging large volumes of treated process water (higher rainfall - less evaporation), (2) enlarging the land area for gypsum stacks, (3) the increase in particulate and sulfur dioxide emissions, (4) greatly increased fuel and electric power consumption, (5) greatly increased railroad tonnages on already crowded and old rail lines, (6) greatly increased cost for product due to rail freight charges.

4.1.3 CENTRAL FLORIDA LOCATION

Location of the chemical complex in the central Florida area would probably be at an existing central Florida chemical plant site already in operation and owned by another phosphate company. There would be no advantage for Occidental to ship their rock to a central Florida location for processing.

In order to continue to use their own raw materials and to keep production costs as low as possible, Occidental would ship their own sulfur and ammonia into the central Florida location, which would incur a higher freight rate than shipping to the present proposed Swift Creek location, thereby increasing production costs. SPA would be shipped from the Port of Tampa instead of the Port of Jacksonville. This would require new facilities at the port for storage and shipping of superphosphoric acid, which should be an even trade-off on port costs. Consideration of the economic factors and environmental permitting factors leads to the conclusion that this is not a realistic alternative.

4.1.4 ENVIRONMENTAL FACTORS

4.1.4.1 Comparison of the Two Local Sites with Respect to Aquatic Communities

No significant impact on the aquatic communities in the Suwannee River and Swift Creek due to the proposed chemical plant is anticipated because regardless of location, discharge waters will enter the Suwannee River via Swift Creek. However, the Swift Creek site requires discharge waters to be channeled through Eagle Lake which has a longer retention period which could result in improved turbidity control.

4.1.4.2 Vegetation: Comparison of the Two Local Sites

The vegetation impacts would be less if the SRCC were to be expanded rather than proceed with construction at the Swift Creek site. Total land area at SRCC utilized would be approximately 40 percent less than that at the Swift Creek site.

Operational impacts to vegetation would be identical for either plant site alternative since discharge is via Swift Creek. Air emission impacts on vegetation would be greater for the SRCC expansion since increase of discharge at a single point would result in higher concentrations of fluorides, sulfur dioxide, and acid mist. This would result in an increase in the probability of vegetation injury.

4.1.4.3 Faunal Comparison of the Two Local Sites

Due to the disturbed nature of habitat in both areas, no significant differences in impacts to the faunal components between the two sites is anticipated. The SRCC expansion would require 40 percent less land than construction of the proposed facilities on the Swift Creek site. However, the probability of vegetative damage from air pollutants from the expansion of the SRCC alternative would increase due to the resulting concentration of discharge sources to a proximate source point.

4.1.5 ALTERNATIVES FOR DISCHARGE OF NONPROCESS WATER, RAINFALL RUN-OFF AND TREATED PROCESS WATER

Three alternatives for routing of these waters were considered. In all three alternatives, associated impacts would occur above entry to Eagle Lake and the discharge for each alternative enters Swift Creek near Occidental. Alternatives 1 and 2 offer the least impact to vegetation since flow is routed through channels. Alternative 3 might stress vegetation in adjacent Swift Creek Swamp during high water levels due to the high sulfate content of discharge water. Further details are available in the Resource Document.

4.2 PRODUCT

Consideration of the increased emissions of fluorides, particulates, increased fuel and electrical power consumption, increased freight costs, and the very remote possibility of renegotiating the Occidental-U.S.S.R. contract, leads to the conclusion that shipping granular triplesuperphosphate (a high analysis solid product), to the U.S.S.R. is not a desirable or practical alternate.

4.3 PROCESS ALTERNATIVES

4.3.1 CLARIFICATION PROCESS ALTERNATIVES

Basically, two alternatives exist for the clarification process leading to SPA: removal of precipitated solids by clarification or a solvent extraction method currently in pilot plant evaluation.

Consideration of the continuous treatment and discharge of a large amount of water similar in quality to treated nonprocess water, and the requirement for storage of large volumes of sludge in aboveground ponds, which may cover valuable mining reserves, leads to the conclusion that at the present stage of development the solvent extraction process is not environmentally or economically attractive. Development work will continue on the solvent extraction process.

4.3.2 HEMIHYDRATE WET PROCESS PHOSPHORIC ACID PROCESS

The hemihydrate wet process for the production of phosphoric acid is an alternative under active consideration by Occidental Chemical Company.

In essence, the hemihydrate wet process phosphoric acid process differs from the dihydrate process in the strength of phosphoric acid produced and the type of by-product gypsum sent to the gypsum stack. Acid strength would be about 40 percent P_2O_5 instead of the 28 percent P_2O_5 produced in the dihydrate process and the gypsum produced is 1/2 water of crystallization instead of 2. Atmospheric fluoride emissions would remain the same. Sulfur dioxide emissions would be slightly reduced. Process water discharge quantity and quality would not change. The deficit water balance for the pond water system is reduced 70 percent and the frequency of treating and discharging pond water would probably be increased. All other process and support facilities remain the same except for a reduction in the number of phosphoric acid evaporators and the elimination of the auxiliary boiler to supply the SPA plants.

4.4 POLLUTION CONTROL MEASURES

4.4.1 COOLING OF SPA

Two alternative pollution control measures are possible, such as the use of totally enclosed heat exchangers to cool evaporated SPA versus the use of cooling coils in vented tanks. The use of totally enclosed heat exchangers to preheat feed to the SPA units instead of cooling coils, using pond water in vented tanks, would reduce a small amount of fluoride emissions from the scrubber venting these tanks. The amount of steam required for evaporation of SPA would be slightly reduced, thereby decreasing the amount of boiler feed water chemicals discharged. Water evaporation from the process water cooling pond would also be slightly reduced, using totally enclosed heat exchangers; however, this pond is already designed for a negative water balance using these heat exchangers.

The main benefit with the totally enclosed heat exchangers is energy conservation. It is planned to design and install this system in the proposed SPA plants, although it has not been proven on a commercial scale.

4.4.2 RETROFIT OF EXISTING SRCC SULFURIC ACID PLANTS

Retrofit of the existing sulfuric acid plants versus construction of new sulfuric acid plants to meet new source performance standards (NSPS) at the Suwannee River Chemical Complex has been considered.

Retrofit of the existing sulfuric acid plants would probably involve double absorption which would require an external heat source using sulfur containing fuel oil, because of the design of the existing plants. Resultant sulfur dioxide emissions to the air from the fuel oil plus the retrofitted plants (to NSPS) would exceed NSPS by a factor of 2 or more.

Replacement of the existing sulfuric acid plants with one large double absorption plant would require a capital expenditure of about $20 million.

Ambient air levels around the existing SRCC complex site meet EPA and Florida DER sulfur dioxide standards at the present time.

Considering the increased capital and fuel consumption for retrofitting the existing sulfuric acid plants, the large capital investment for a new double absorption sulfuric acid plant, and the fact that ambient air SO_2 standards are now being met, leads to the conclusion that neither of these alternatives would be viable.

4.5 ALTERNATIVE OF NOT CONSTRUCTING A NEW SOURCE

4.5.1 THE ECONOMIC EFFECTS OF A NO-ACTION ALTERNATIVE

The effects of a no-action alternative on the local area can basically be seen in the baseline socioeconomic projections in Section 2.8.3 of the Resource Document. Those projections were made on the assumption that the expansion would not occur. Occidental has, of course, proceeded with Phase I of their expansion and will meet their commitments to the U.S.S.R insofar as possible. Thus, some of the international trade benefits of the agreement could be realized, unless the entire contract fell into default. However, if the Phase II expansion were not completed, most of Occidental's existing capacity would have to be devoted to satisfaction of the U.S.S.R. agreement. Thus, Occidental's capacity would be effectively removed from the available capacity to meet the U.S. phosphate fertilizer needs. As was shown in Section 1.3.3, this capacity will be needed to meet the growing fertilizer requirements of U.S. farmers in the future.

Thus, no action alternative would result in a lower level of employment and incomes within the three-county area and Florida, higher unemployment, lower tax collections by local and state governments, and lower expenditures by local governments. State government expenditures would be little affected in either case. The no-action alternative would also, of course, result in a somewhat slower development of residential commercial and industrial land than would be the case with the development. The precise level of these effects can be seen in Section 3.2.1. However, minor effects would be seen on the pace of residential, commercial and industrial land development.

SECTION 5.0

MITIGATIVE MEASURES

5.1 AIR QUALITY AND NOISE

5.1.1 AMBIENT AIR QUALITY

The U.S. Environmental Protection Agency and the Department of Environmental Regulation of the State of Florida have established the following standards and guidelines that define acceptable ambient concentrations of air contaminants consistent with established air quality criteria. The following pertinent standards are taken from Chapter 17-2 of the Department of Environmental Regulation.

5.1.1.1 Particulate Matter

1. 60 micrograms per cubic meter - annual geometric mean.
2. 150 micrograms per cubic meter - maximum 24-hour concentrations not to be exceeded more than once per year.

5.1.1.2 Sulfur Oxides (Sulfur Dioxide)

1. 60 micrograms per cubic meter (0.02 ppm) - annual arithmetic mean.
2. 260 micrograms per cubic meter (0.01 ppm) - maximum 24-hour concentration not to be exceeded more than once per year.
3. 1,300 micrograms per cubic meter (0.50 ppm) - maximum 3-hour concentration not to be exceeded more than once per year.

5.1.1.3 Fluorides

A departmentally established guideline of 45 ppm F^- in grass has been used as an indicator of fluoride pollution. This criteria is related primarily to potential harm to cattle.

5.1.2 EMISSION REGULATIONS

Industrial emissions are regulated by a series of stipulations all contained in Chapter 17-2.04 of the Florida Administrative Code (F.A.C.) These regulations include general provisions dealing with limits on visible emissions, process weight table, etc., but in addition, has specific industry limitations, some being applicable to the phosphate fertilizer industry. By reference, when federal New Source Performance Standards exist for a particular industry or process (such as sulfuric acid plants), then these standards apply rather than the limits of 17-2.04. Emission limits of particular interest in this EIS are as follows:

5.1.2.1 Sulfuric Acid Plants

1. New Plants

   a) Four pounds SO_2 per ton 100% H_2SO_4;
   b) Acid mist up to 0.15 pounds per ton of 100% H_2SO_4;
   c) No visible emissions except during start-up.

5.1.2.2 Phosphate Processing-limits expressed as pounds of fluoride (atomic weight 19) per ton of P_2O_5 equivalent of input material.

1. New Plants

   a) Wet process phosphoric acid production-0.02 pounds F per ton P_2O_5 fed to process;

   b) Superphosphoric acid production 0.01 pounds F per ton P_2O_5 fed to process;

   c) Run of pile triple super phosphate mixing belt and den - 0.05 pounds of F per ton;

   d) Run of pile triple super phosphate curing or storage process -0.12 pounds F per ton;

   e) Granular triple super phosphate production-0.06 pounds F per ton for granulating run-of-pile triple super phosphate or 0.15 pounds F per ton for product made from phosphoric acid and phosphate rock slurry;

   f) Granular triple super phosphate storage-0.05 pounds F per ton;

   g) Diammonium phosphate production-0.06 pounds F per ton;

   h) Calcining except rock drying and defluorinating -0.05 pounds F per ton;

i) Defluorinating phosphate rock -0.37 pounds F per ton;

j) All other plants or processes will be subject to best technology.

The proposed facility will meet these emission limits and, in addition, will operate continuous monitors to record emissions and ambient levels of SO_2.

5.1.3 PREVENTION OF SIGNIFICANT DETERIORATION

With the issuance of proposed guidelines by EPA in November 1977, the FDER became active and passed regulations compatible with those of EPA. The new "PSD" regulations, as reflected in Chapter 17-2.02, established three area classes and degradation limits in each. Class I, II and III areas are designated in descending order of air quality, i.e., a Class I area is to be as free of air pollution as possible and at present is assigned to federally designated seashore and national forest areas. One such area near the Occidental Chemical site is the Okefenokee National Wilderness Area.

5.2 LAND AND WATER RESOURCES

5.2.1 TOPOGRAPHY

The proposed site is located outside the limits of stream courses and flood-prone-areas in the Swift Creek drainage basin.

Retirement of the gypsum stack could consist of flattening its slopes and incorporating a clayey soil cover that will be grassed.

5.2.2 GEOLOGY

The chemical plant will not have any effect on the main Hawthorn confining unit. There are no mitigating measures for the loss of mineral resources that are mined.

5.2.3 SOILS

5.2.3.1 Erosion Control

Building, embankment, storage and borrow areas will be grubbed only as necessary just prior to construction. Borrow areas that will not be used for mining purposes will be revegetated to reduce the incidence of erosion. Runoff from the earthen embankments and from the plant site will be collected in ditches and clarified before it is permitted to enter surface water courses, with further clarification occurring at Eagle Lake prior to discharge to Swift Creek. Runoff from exposed mining areas and spoil piles will be collected in perimeter ditches and in adjacent mine pits and will be clarified before being allowed to enter surface water courses to meet State water quality regulations.

5.2.3.2 Dust Control

During construction, heavily trafficked areas will be wetted down to control dusting. Roads within the chemical complex will later be paved to prevent dusting. Other areas disturbed during construction will be grassed.

5.2.3.3 Gypsum Stack Retirement

Mitigative measures to reduce and/or eliminate potential impacts from the retired gypsum stack could include: (1) digging out some of the gypsum and selling it as a soil conditioner for farming (e.g., peanuts); and (2) flattening the slopes of the gypsum stack and covering the gypsum surface with a 2- to 3-foot thick "impervious" clay liner, as is customarily done for a sanitary landfill. This should prevent further percolation and leaching of the gypsum and would reduce or eliminate the contamination of surface runoff requiring treatment. The clay cover could be seeded with grass having a shallow root system, such as that used for pasture. This would eliminate the potential for dust and erosion.

5.2.4 SURFACE WATER QUANTITY

Mitigative measures to reduce nonprocess water discharges to Swift Creek include: (1) the recycling of equipment cooling water and vacuum pump seal water from the phosphoric acid processes to the sulfuric acid plants cooling tower for use as makeup water; and (2) the recycling of evaporator condensate from the phosphoric acid processes to the sulfuric acid plant boilers.

Measures to limit the discharge of treated process water to periods of heavy rainfall include: (1) the production of 98% sulfuric acid instead of 93% acid which increases the heat of reaction in the wet process phosphoric acid plant reactor, thereby increasing the process water pond deficit; (2) the design of a water pond system with a negative water balance; and (3) incorporating in the design of the gypsum stack-cooling pond system a surge capacity for "zero" discharge; i.e., rainfall from the 25-year/24-hour storm can be stored within the system. The cooling pond will be designed to maintain 1.5 times the volume of precipitation from the 25-year/24-hour storm. Thus, while still maintaining the necessary freeboard, rainfall from the 25-year/24-hour storm will not completely use up the available surge.

The negative water balance designed into the system will make it possible to direct some of the nonprocess water to the process water pond during dry periods, thus reducing the discharge of nonprocess water during these periods.

Other mitigating measures include monitoring of Occidental discharges and of Swift Creek flows (by the stream gauge recorders installed in conjunction with this study) and reporting the data to EPA and the Florida DER.

5.2.5 GROUNDWATER QUANTITY

5.2.5.1 Surficial Aquifer

A below-ground cooling pond will surround the gypsum stack. The water level in the cooling pond will be maintained within a few feet of the water-table in the surficial aquifer. These measures will eliminate potential effects on the groundwater level in the surficial aquifer and the impacts, if any, would be very localized.

5.2.5.2 Floridan Aquifer

Mitigative measures will be taken to limit the withdrawals from the Floridan Aquifer. These measures include: (i) the production of 98 percent sulfuric acid instead of 93 percent acid which eliminates the need for 98-93 percent dilution coolers: this measure decreases the free water in the product (sulfuric acid) and reduces the heat load to and the evaporation from the cooling tower, thereby reducing well water use; (ii) the recycling of 1365 gpm of equipment cooling water and vacuum pump seal water from the phosphoric acid processes to the sulfuric acid plant cooling tower for use as makeup water; and (iii) the recycling of about 637 gpm of evaporator condensate from the phosphoric acid processes to the sulfuric acid plant boilers. These measures significantly reduce the well water consumption.

Monitoring of water levels in observation wells installed in conjunction with this study and in existing Occidental supply wells will be undertaken as a mitigating measure for assessing the impact of withdrawals and leakage on groundwater quantity.

5.2.6 SURFACE WATER QUALITY

5.2.6.1 Construction Phase

Mitigative measures to prevent the contamination of surface waters by suspended solids during the construction phase of the project have been summarized in Section 5.2.3. These measures consist of clarifying the runoff in surface water bodies prior to discharge to Swift Creek. Potential erosion from dikes will be mitigated by maintaining perimeter ditches, thereby creating a closed system that will discharge to surface waters after clarification occurs in various ponds and lakes.

5.2.6.2 Treated Process Water Discharge

If discharged, process water will be treated in a two-stage neutralization system using limestone and lime. The process water will be allowed to settle in a settler or settling pond after each treatment stage to remove suspended solids. Provision for enough surge to collect the 25-year/24-hour storm in the cooling pond prevents overloading the neutralization system and allows good control of the neutralized water to meet discharge standards. Treatment of process water will be limited to periods of heavy rainfall, i.e. whenever more than 50 percent of the available surge is used.

Routine monitoring of the level of water in the process water pond allows for the maintenance of the surge for the 25-year/24-hour storm. Monitoring and control of the water level in relief ditches surrounding the gypsum stack and any above-ground cooling pond allow for collection of the seepage.

Monitoring will be done by sampling and by performing chemical analyses on treated process water effluent when discharging, in order to be in compliance with NPDES permit conditions.

5.2.6.3 Nonprocess Water Discharge

Nonprocess water will discharge to a freshwater ditch in the chemical plant leading to a nonprocess surge pond. Effluent from the surge pond follows another freshwater ditch discharging into Eagle Lake (in Section 10) which discharges, in turn, into Swift Creek.

Mitigative measures that will be taken by Occidental Chemical Company to reduce the potential of nonprocess water contamination include: (i) the use of wet phosphate rock instead of dry rock, a measure which eliminates the need for a dryer and dryer scrubber, thus eliminating the potential pollution from weak sulfurous scrubber liquor containing suspended solids; (ii) recycling of phosphoric acid evaporator condensate to the sulfuric acid plant boilers, thus reducing the amount of water treatment regeneration effluent; and (iii) the diversion of contaminated phosphoric acid evaporator condensate to the process water circuit in order to reduce the amount of contaminated nonprocess water requiring treatment.

Prevention and control of contamination of nonprocess water will be accomplished by: (i) the isolation of nonprocess water from the process water and acid storage areas - the contaminated areas will be curbed and separated from nonprocess waters and rainfall runoff ditches; (ii) any point source nonprocess water discharge that could become contaminated by leaks or spills from acid areas will be routinely pH monitored to allow for diversion of the contaminated water to the process water system for as long as the pH is not back to normal; (iii) nonprocess water that is not contaminated and rain runoff from nonprocess areas will be diverted to the nonprocess surge pond which will have a retention time of about 100 days except during rainfall periods. The influent to and effluent from the surge pond will have an automatic continuous pH recording and alarm system to prevent discharges of contaminated water to surface streams and to allow for prompt corrective action to be taken. The 100-day retention time will also dampen any contamination of nonprocess water entering the pond; (iv) if contamination occurs, the discharge will be diverted to the second stage process water treatment system for neutralization with lime and settling in a pond so that the contaminated nonprocess water meets discharge requirements; and (v) any treated overflow from the settling pond and uncontaminated effluent from the surge pond will be discharged to Eagle Lake for final clarification. This lake has a retention time of 156 days except during rainfall periods. The extended retention time will allow for removal of suspended solids and will further dampen out any pH and contaminants should all of the above control actions malfunction, a hypothesis that is highly unlikely.

Some nonprocess water discharges will be diverted to the Swift Creek Mine water circuits. These include: (i) the discharge of water treatment regeneration effluent (≈ 13 gpm) diverted to the mine water circuits in order to reduce the concentration of regeneration chemicals discharged to surface waters; and (ii) the discharge of treated domestic water (≈ 16 gpm) after treatment to Florida DER Standards, diverted to the mine water system to eliminate the discharge of treated domestic water to surface waters.

Occidental Chemical Company will also reduce or possibly eliminate its discharges during drought periods which will, in turn, reduce and/or eliminate the potential impacts of discharges on surface waters during critical low flow conditions. The nonprocess surge pond with 100-day detention time, and Eagle Lake with 156-day detention time, allow for the control and management of discharge in dry periods to minimize the effect of changes in surface water quality of Swift Creek and the Suwannee River. The temporary storage of effluents in retention ponds and lakes will allow for future discharge to Swift Creek when flow conditions in the Suwannee River are more suitable.

Monitoring in order to comply with NPDES permit conditions will be done by sampling and performing chemical analyses on nonprocess water effluent, and by recording the discharge rate and reporting the data to EPA and the Florida DER. Further, the stream gauge recorders installed in conjunction with this study will be maintained and the records will be analyzed as data is accumulated. Surface water sampling and complete water chemical analyses at the location of the stream gauges will continue on a regular bi-monthly basis during construction and operation of the proposed facility.

5.2.6.4 Retirement Phase

After retirement, continued treatment of runoff from the gypsum stack-cooling pond complex will be required until the runoff is of acceptable quality that satisfies discharge standards.

5.2.7 GROUNDWATER QUALITY

Mitigative measures have been incorporated in the two schemes that are being considered for the gypsum stack-cooling pond complex. In mined-out areas, a below ground cooling pond will surround the stack and will act as a relief for water seeping from the stack area. Where an aboveground cooling pond surrounds the stack, its outer periphery will be excavated to provide a relief for water seeping from the stack. Seepage from the stack and aboveground cooling pond would, therefore, tend to flow to the below ground cooling pond which acts as a sump.

The impacts of the proposed facilities will be directly measured by monitoring water quality in the observation wells installed in conjunction with this study. This sampling will be done at least twice a year on a regular basis during construction and operation of the proposed facility.

Occidental Chemical Company proposes to operate with the level of water in its below ground cooling ponds slightly above the water table in the surficial aquifer. In the unlikely event that the monitoring program indicates significant contamination of the surficial aquifer, Occidental will lower the operating level of its below ground cooling ponds to provide additional relief for water seepage. This measure would, however, reduce the process water pond deficit, thereby requiring more treatment and discharge of process water to surface streams.

Occidental will not extend its mining at the site of the gypsum stack-cooling pond complex to the confining unit and, hence, the confining bed would not be affected by mining operations. No measurable impacts are projected on water quality in the Floridan Aquifer. The water quality in the aquifer will, however, be monitored through Occidental supply wells and the deep observation wells installed in conjunction with this study.

5.2.8 ACCIDENTS AND SPILLS

The gypsum stack-cooling pond complex will be designed in accordance with state-of-the-art practices. Although the site is not susceptible to damaging earthquakes, the design will also comply with requirements of Earthquake Zone 1. There are no state or federal rules that apply to the design of the gypsum stack.

The rules of the Department of Environmental Regulation for the design, construction, inspection and maintenance of earthen dams promulgated under Chapter 17-9, Florida Administrative Code, will be strictly adhered to. Earthen retaining dikes will also comply with all other state and/or local ordinances.

The construction of retaining dikes will be inspected daily by a qualified representative of the design engineer to determine that the embankments, spillways and control structures meet the design specifications. Prior to the introduction of process water into the area, the entire earthen structure will be thoroughly inspected by the design engineer.

The earthen dikes of the cooling pond-gypsum stack complex will be inspected on a routine basis by operations personnel, who will be instructed by the design engineer regarding items to be checked. The inspection will consist of checking the general condition of the crest and toe inspection roads, the condition of soil surfaces on the outside slopes and downstream from the toe, the elevation of the impounded fluid, the piezometric level within and adjacent to the embankments, and nonprocess water ditches and surge ponds. Evidence of concentrated seepage, cracking or subsidence of the crest, sloughing of the downstream toe, or the appearance of significant erosion gullies will be immediately brought to the attention of the design engineer. Remedial measures will be taken as soon as an unexpected condition is detected in order to prevent leaks and/or dike failure.

A thorough and detailed annual inspection will also be undertaken by a qualified geotechnical engineer until the gypsum stack is ultimately reclaimed.

The probability of having a spill of the ponded water from on top of the stack is very low. Nevertheless, the cooling pond surrounding the stack is designed with enough surge capacity to contain acid water that may be stored on top of the stack. Such a spill will cause a rise in the water level of the cooling pond that will not exceed one foot (and more than likely, will be on the order of 0.5 feet). This is well within the available surge capacity.

The isolation of acid process areas and acid storage areas from nonprocess water and rainfall runoff ditches reduces the potential of contamination of nonprocess waters. Mitigative measures outlined in Section 5.2.6.3 allow for the recovery of process water from leaks and spills (by diversion to the process water system) and/or for treatment of the contaminated waters prior to discharge.

5.3 BIOLOGY AND ECOLOGY

5.3.1 AQUATIC COMPONENTS

Retention ponds will impound construction runoff and allow suspended sediments to settle prior to discharge to mitigate potential impacts of increased turbidity on aquatic organisms. Impacts of chemicals in discharge waters on aquatic organisms will be minimal because treated process water will be infrequently discharged. The proposed facility incorporates the latest features for minimizing the contact of process water with natural aquatic systems.

5.3.2 TERRESTRIAL COMPONENTS

Incorporation of storm runoff retention ponds during construction of the proposed chemical plant will minimize potential sedimentation impacts on the Swift Creek Swamp vegetation. Establishing natural plant species on areas that are cleared, but not used, will provide some food and cover for wildlife. Meeting federal and state air emission standards will mitigate the impact of chronic injury to vegetation.

5.4 MITIGATIVE MEASURES FOR SOCIOECONOMIC ENVIRONMENT

The socioeconomic impacts of the Occidental expansion plan are almost entirely beneficial so that no mitigation is necessary. There are, however, at least temporary problems that may occur. These are detailed in section 5.4 of the Resource Document. For the most part, the possible problems that may occur stem from the likely lag in time of receipt of additional public revenues relative to the time that increased public costs are incurred as a result of increased demand for public services.

These problems, however, can be mitigated by advanced planning on the part of local governments with the aid of state and regional planning agencies. No major or permanent problems are anticipated however.

5.5 RADIOLOGICAL

5.5.1 SURFACE WATERS

Off-site impact of radioactivity in surface waters will be mitigated by compliance with a NPDES permit limiting effluents to less than 9 pCi/l radium-226. The surface water surveillance data indicate that off-site surface waters will remain near the radioactivity levels of natural surface waters in the area.

5.5.2 GROUND WATERS

Ground water contamination by other pollutants of a more soluble nature is likely to be the critical factor in identifying seepage. Radium-226 is extremely insoluble and seepage water traveling downward through the strata must pass through areas containing high quantities of radium-226. If mitigative measures for other contaminants are instigated, it appears that this will be sufficient to insure that ground water contamination by radium-226 is not a problem.

Ground water monitoring at the SRCC site neither substantiated nor negated the hypothesis of radium-226 seepage from source water into the superficial aquifer.

5.5.3 GYPSUM STACK

An important waste product to be considered is that of the gypsum. In the chemical processing radium-226 is concentrated in this calcium sulfate matrix. The gypsum stack presents a considerable reservoir of radioactivity for the future. However, preliminary data from the west central Florida area has not indicated any appreciable problem due to this waste material.

The EPA area-wide EIS (EPA, 1978) listed under "Proposed Actions" that lining of gypsum ponds with an impervious material as a mitigative measure to protect ground water from radiological contamination unless site specific data indicate otherwise. The north Florida site results in gypsum having a concentration of radium-226 approximately one half that of west central Florida. Proposed designs for the gypsum stack mitigates gradients for seepage of any dissolved radium-226. Lateral transport of fine suspended particulates is not expected. The mitigative measure proposed for retiring the gypsum stack (Section 5.2.3.3) is considered adequate for long-term control of the radiological aspect of this approximately 14 pCi/g radium-226 material.

5.5.4 AIR QUALITY

The most significant radiological impact on the environmental air quality at phosphate complex results from rock-drying processes at beneficiation. The EPA areawide EIS has proposed the elimination of rock-drying and suggested the transport of wet rock to chemical plants. The proposed chemical plant will process wet rock. Drying rates at the SRCC will either be reduced or remain the same as a result of the construction of the proposed plant.

5.5.5 OCCUPATIONAL EXPOSURES

Levels of radiation and radioactivity in and around the various processes are not of sufficient magnitude to consider the application of radiation control area guidance and consideration of workers to be occupationally exposed to radiation. A very specific but short-term problem exists in cleaning some of the reaction vessels when scale accumulates.

Limiting exposure times for any individuals to less than five days per year and providing respiratory control equipment when cleaning such vessels will adequately mitigate this problem.

5.6 CULTURAL RESOURCES

The historical and archaeological survey has failed to reveal sites of National Register significance on the Occidental SPA tract. A nearby settlement of mill shanties associated with the Camp lumber operation was found to date to the turn of the century. Camp's Still is neither within the survey area nor considered eligible for inclusion in the National Register.

No evidence of prehistoric occupation could be found despite examination of large areas of cleared ground. Generally, the tract has been severely disturbed by mining, clearcutting, pine cultivation, industrial development, and utilities and transportation construction. No mitigation is required.

LIST OF REFERENCES
(Section 5.5)

EPA (1975), "Preliminary Findings: Radon Daughter Levels in Structures Constructed on Reclaimed Florida Phosphate Land"; U.S. Environmental Protection Agency, ORP/CDS-73-5.